OCTOBER, 1940

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In This Issue
TRAINING MEN FOR AVIATION

AVIATION

The Oldest American Aeronautical Magazine

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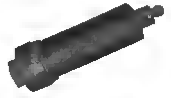

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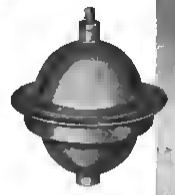
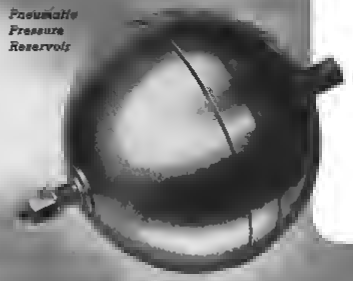


5 inch Accumulator



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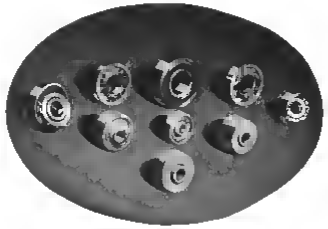

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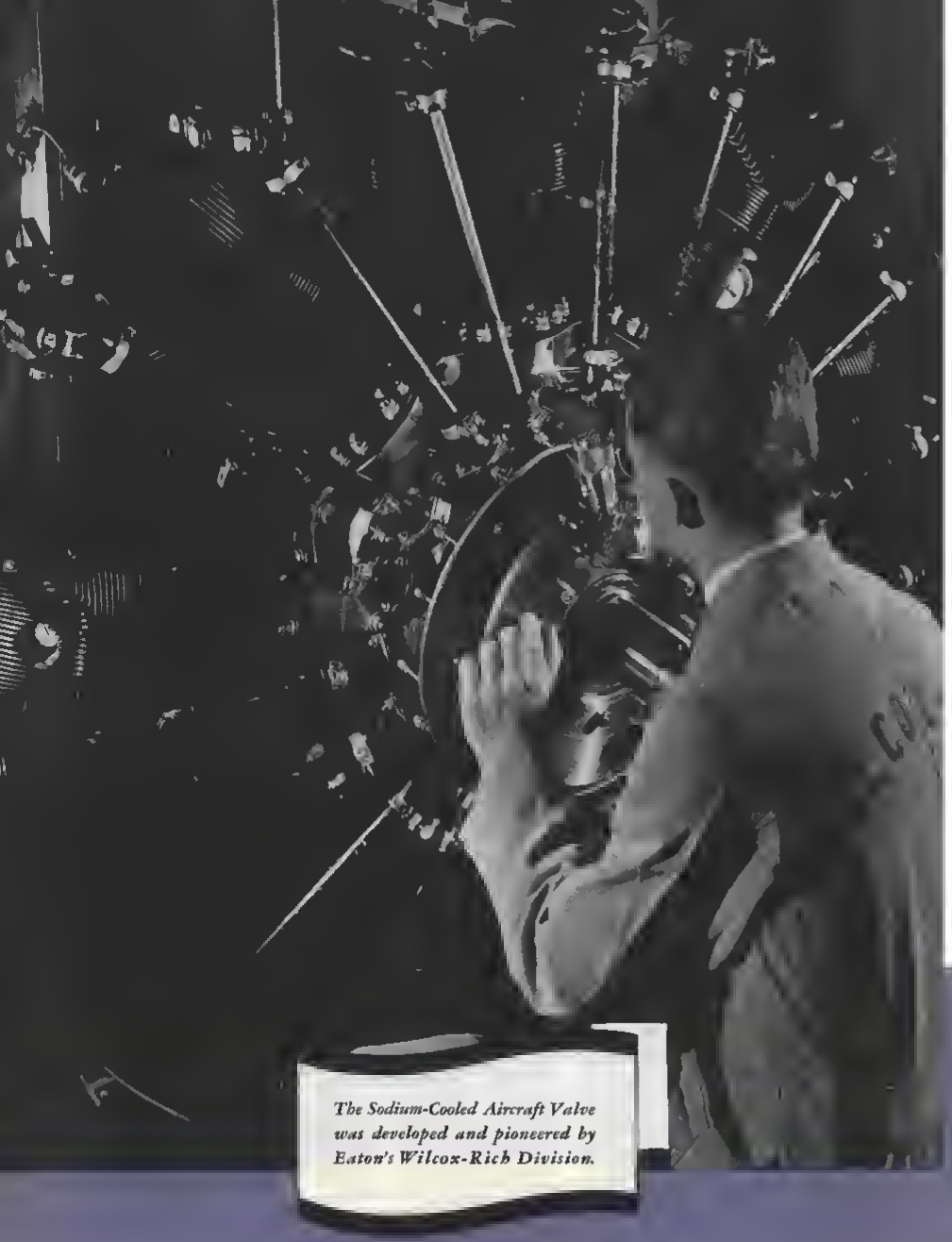

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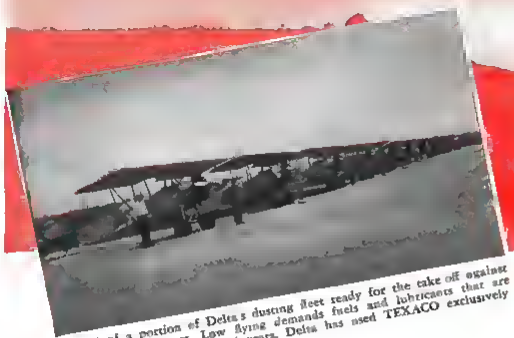

LINE-UP of a portion of Delta's dusting fleet ready for the take off against some destructive pest. Low flying demands fuels and lubricants that are there in the pinches. For 14 years, Delta has used TEXACO exclusively

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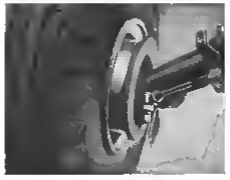

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Aviation

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AVIATION IS INDEXED IN READERS GUIDE TO PERIODICAL LITERATURE AND IN INDUSTRIAL ARTS INDEX

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VOL. 20 NO. 10
REGULAR EDITION

OCTOBER 1940

FLASHES

picked up along the editorial airways

Orders at last

» SIGNS OF LIFE in air defense matters began to appear slowly last month We were just beginning to think that the aircraft procurement program was a myth when suddenly someone cast formalities to the four winds and, without any money, the Navy made a deal with Pratt & Whitney for 17,000 engines A few hours later the Army made another dicker with Curtiss-Wright for 20,000 engines and a lot of propellers These agreements couldn't be called contracts because they were made before the $5 256,000,000 second Special Defense Appropriation Bill was passed They were not quota assignments because the manufacturers had a pretty good idea of what was expected of them a long time before the deals were made In fact the engine and plane makers, fortunately for the country, had started their expansion plans a long time earlier on the strength of letters of intention from the military services We were afraid for a while that these good intentions were of the same variety with which London had been paved

» BESIDES THE RECORD SIZE of these orders and the fact that they have started the ball rolling, there is another bright spot in the picture that deserves comment The fact that the Navy made its deal with one manufacturer and the Army with another doesn't mean that all the P & W engines are for the Navy and all the Wrights are for the Army It is part of a new policy under which each branch of the service deals with specific manufacturers It looks like a much needed step toward some degree of standardization in Army and Navy requirements In any case it will eliminate a lot of unnecessary red tape and will reduce the number of inspectors needed at the plants Naturally there will be some basic differences in the requirements of the two services But there have been altogether too many in the past

» MR KNUDSEN HAS BEEN GETTING AROUND lately and it is interesting to hear what this master of mass production has to say about the airplane industry As a result of his travels, which include visits to most of the defense plants in company with General Arnold, he has become a strong booster for our manufacturers His public utterances have done much to blast this cheap, uninformed talk about industry's failure to cooperate in the defense program He has stated frequently and clearly that he has received the utmost cooperation in all of his visits, and a series of expansion programs have been announced in his wake One quotation follows.

'I saw a tremendous amount of expansion that has taken place in an extremely short time and everywhere I found that the quality of production is all right. . . . With that as a base I feel that we can build and go still further We make the best planes in the world and, before we get through, I believe we can make the most"

» WE CAUGHT UP with Mr Knudsen and General Arnold at Buffalo while they were visiting the Curtiss factory and we learned the latest figures on the program In general they

"We make the best planes in the world and before we get through, I believe we can make the most." So spoke Defense Commissioner William S Knudsen (right) while visiting the Curtiss-Wright plant at Buffalo with General H. H. Arnold, Chief of the Air Corps (left center). Burdette S Wright, vice president and general manager of Curtiss Aeroplane Division (left) was host and Dee R Berlin, chief engineer of the Curtiss plant is seated between General Arnold and Mr Knudsen.

agree with those published in AVIATION for August. Productive capacity, 3 000 per month (excluding pleasure ships) by the spring of 1942. A total production of 33 000 military craft—19 000 for us and 14,000 for England in the same period. Sixty percent of our 19 000 to be combat planes, the remainder trainers and transports. Floor space expansion will be from 8 000 000 to 20 000,000 square feet.

» IN BUFFALO we saw single-seater P-40s coming off the line every few hours at a rate of about three a day. Even more encouraging was the observation that there was a "backlog" of about a dozen Allison engines and no indication of any shortage. Mr. Knudsen promised an output of 150 Allisons for September. The huge Curtiss plant now has 8,000 employees and will be still further expanded in the not distant future.

» OVER AT BELL AIRCRAFT, the first ten Airacobras are being turned out. More than 600 of these are on order by the Army and by contracts with the French and British Purchasing Commissions.

» SABOTAGE—has reared its ugly head in several spots recently, and manufacturers are on the alert to guard against it. But a large part of that which bears the earmarks is not sabotage at all. It is the result of carelessness, smart-aleck curiosity, or honest mistakes. And this is likely to increase with the size of the industry. It is the patriotic responsibility of every aviation factory worker to be sure his job is done thoroughly and to watch for the mistakes of others along the production line. Where there are men who show inclination to experiment with critical devices or gadgets, their work should be doubly checked. Much grief can be eliminated by a check on fire problems as expressed in a recent statement by John Kidde of Walter Kidde & Company. He points out that no country accepting foreign orders or engaged in a defense program can expect to avoid sabotage fires. He advocates three simple steps: (1) Institute a campaign for top notch plant housekeeping, to eliminate unnecessary hazards and careless habits, (2) teach employees how to fight fires, organize fire brigades and stage frequent fire drills, and (3) analyze the hazards in plants and warehouses and adopt the most advanced fire safeguards. In this last step, the advice of insurance men, fire department officials and manufacturers of fire protection equipment can be of great help.

« SOME CRITICAL CONGRESSMAN should be made to do the job "Jack" Northrop selected for himself the other day. Locked in his large new wind tunnel he propped himself against the vanes just upstream from the 15-ft. four-bladed prop driven by its 1,200 hp. Wright Cyclone engine, and observed the vibration of the huge propeller. The new tunnel is a duplicate of the one at Caltech and has been built at Hawthorne, Calif. Details are presented on page 46. It is one of the answers to those who have wondered whether research would go on or be lost in the shuffle of large quantity production.

» LEST WE FORGET the private aircraft industry, which is thriving along with the military manufacturers, we slipped down to Lock Haven on Sept. 12 to help Poppa Piper celebrate the tenth anniversary of the first Cub flight, and to look over his particular expansion program. Among those present was C. G. Taylor, who designed and built the first and many other Cubs, and George Kirkendall, who had his old log book showing that he had flown the ancestor of so many light planes. The new additions will bring the plant capacity up to 173,000 sq. ft. The present two-story plant has turned out as many as 90 Cubs in its peak week this year, and turned out more than 1,800 planes last year. President Piper is talking about 3 000 for this year and 6 000 in 1941. We are not at all sure that the military services are absolutely right in overlooking the light planes for defensive purposes. But if a need for them should ever be found, there will be plenty of them available and they can be turned out in even greater numbers almost immediately.

IT PAYS TO FLY

"The government has a large stake in Maguire's new factory."

Side Slips

By Robert Osborn

» THE ENGLISH weather bureaus must be considerably pleased by the fact that publication of their weather forecasts has been forbidden by the censor as information useful to the enemy.

Over here, according to the cartoonists and radio gag writers, such weather forecasts would be considered as information most likely to confuse the enemy, and publication or broadcasting would be enthusiastically encouraged.

» IT IS OUR PLEASURE to have read, a short while ago, the beautifully-written book of Antoine De Saint Exupery,—"Wind, Sand and Stars," and we certainly recommend the book to anyone who has not already read it.

In the stark reality of events which have taken place so rapidly in Europe since the book was written there is one passage which stands out from the pages as if underscored in red. In describing one night spent on the Sahara desert, after his mail plane had been forced down, he mentions lying in the sand thinking over pleasant memories of his childhood home, and comments on the old housekeeper:

"Ah, I owe you a page, Mademoiselle! When I came home from my first journeyings I found you needle in hand, up to the knees in your white surplices, each year a little more wrinkled, a little more round-shouldered, still preparing for our slumbers those sheets without creases, for our dinners those cloths without seams, those feasts of crystal and of snow.

I would go up to see you in your sewing room, would sit down beside you and tell you of the dangers I had run in order that I might thrill you, open your eyes to the world, corrupt you. You would say that I hadn't changed a whit. Already as a child I had torn my shirts—'How terrible!'—and skinned my knees, coming home as day fell to be bandaged.

No, Mademoiselle, no! I have not come back from the other end of the park but from the other end of the world! I have brought back with me the acrid smell of solitude, the tumult of sand-storms, the blazing moon-light of the tropics! Of course! you would say 'Boys will run about, break their bones and think themselves great fellows!'

No, Mademoiselle, no! I have seen a good deal more than the shadows in our park. If you knew how insignificant these shadows are, how little they mean beside the sands, the granite, the virgin forests, the vast swamplands of the earth! Do you realize that there are lands on the globe where when men meet you, they bring up their rifles to their cheeks? Do you know that there are deserts on earth where men lie down on freezing nights without roof or bed or snowy sheet?"

Who could have known even so short a time ago, Brother Antoine, how peaceful and merciful your Moors of the Sahara would be considered, by comparison. Wherever you may be, we hope that all goes well with you,—and with the old housekeeper.

» EXPERIENCE WITH EXPERIENCE. A young engineer is sure to get a little "uppity" when placed in charge of his first project, and it does a lot of good if someone takes him down a few pegs.

My first design job was that of installing an experimental set of automatic slots on the wings of a Navy fighter, and like all project engineers, newly made, I thought my job should have first priority in drafting room and shop. The Chief Engineer and Shop Superintendent were used to that sort of thing however, so the work was given exactly the priority it deserved.

The first few test flights at the field indicated that the slots were in need of some adjustment to make them open together and at the correct speed, so I went in to the Assembly Foreman to get a mechanic.

"Let's see," he said, "You can have that man over there if you want him."

"Never saw him before."

"He's a new man. Hired him the day before yesterday, but I think he's good."

I took him, and his box of tools, over to the field in the car. There I explained very patiently and as simply as possible how an automatic slot worked and just what adjustments to the mechanism were necessary.

When I had finished, the new mechanic said "That's an interesting arrangement you have there for adjusting the slots. Dr. Lachmann in Germany adjusts his this way" (making a sketch on a pad he had taken out of his tool kit). "and Handley Page in England uses this type of mechanism. However," he continued, "both of those men were working with thinner airfoils than the one on this ship. Do you think you'll get the same percentage lift increase, or will you just get the same maximum lift?"

I lit a fresh cigarette to replace the one I had dropped, and asked, "Have you worked on slot installations before?"

"Oh yes," he said, "For about three years,—on the experimental work with them."

"In Germany and England?"

"Yes."

"How long have you been in aviation?"

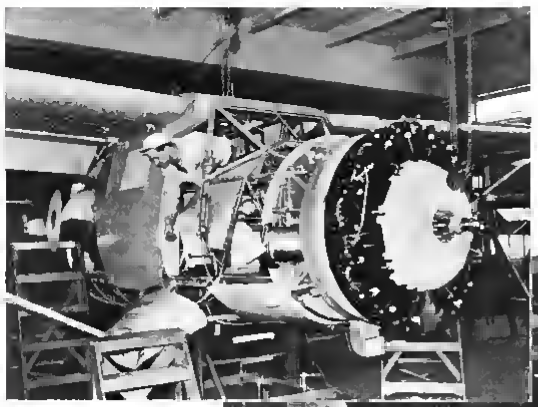
"Since about 1913. Learned to fly then and flew as a pursuit pilot all through the war. But flying jobs have been scarce so I've been sticking on work as a mechanic since then."

'Oh" I said, and drove on back to the office.

Star Newspaper Service

Production line of de Havilland Tiger Moth elementary trainers at the factory near Toronto.

Star Newspaper Service



Above—The assembly of a Noordwyn Norseman used for radio and observation training, at the plant near Montreal.

Right—A Wright Cyclone engine on a Northrop Delta at the Canadian Vickers plant.

Canada's

A Supermarine Stranraer Flying Boat under construction at Canadian Vickers plant.

Warplane Industry

What twelve months has accomplished in building a permanent aircraft industry

By James Montagnes

CANADA'S rapidly expanding aircraft industry will assure the Dominion a post-war aircraft factory plant capable of supplying practically all Canadian military, commercial and private airplanes. Just as World War I brought Canada an automotive industry which now exports to all parts of the British Empire under preferential tariffs, so the necessities of war are giving Canada an airplane production which after the war will largely eliminate the importation of commercial and military airplanes from Great Britain and the United States.

Under the exigencies of war Canada's aircraft industry has rapidly grown from a fledgling with trial orders of military aircraft started prior to the outbreak of war (AVIATION, April, 1939). Just before the end of the first year of the war, Canada's airplane plants were employing 17,000 in all fields of aircraft production, exclusive of an assembly company working on British war orders. This according to Munitions and Supply Minister, C. D Howe, who also announced about that time that early in 1941, 360 airplanes a month would come from Canada's aircraft plants.

The Canadian industry has been faced with a three-fold task: to produce airplanes ordered (1) by the British government, (2) for the Royal Canadian Air Force, (3) for the British Empire Air Training Plan. All have been urgent, and production for the three needs had to be correlated.

Because Canada is at war it is not possible to give all the details of her aircraft industry. Information on actual production and employment in individual plants cannot be obtained. Nor is data available on the full purchasing scope of the Canadian and British governments in the Canadian industry. But sufficient data is available from official and authoritative financial sources to show briefly the job the industry is doing.

British government orders were supplemented by an order for 600 Hurricane fighters late this summer. Canadian Car & Foundry Co. Ltd., Montreal, has been manufacturing Hurricanes on trial for the British Air Ministry, and success of the first of these has led to the placing of this largest order to date by the British government. The order is valued at upwards of $15,000,000 for the planes less engines and accessories. Other British government orders include an unstated number of Handley Page Hampden bombers being assembled by Canadian Associated Aircraft Co. Ltd., at Montreal and Toronto, and a number of other planes on which no information is available. British government aircraft orders for Canadian plants move through Morris W. Wilson, president of the Royal Bank of Canada (one of Canada's three big banks) who is agent for aircraft for the British government with the British Purchasing Commission at New York.

For the Canadian government, biggest job the aircraft industry is doing is turning out planes for the British Empire Air Training Plan, a joint op-

(*Turn to page 98*)

Where Are Those Profits?

The huge profits alleged to have heen made in the aviation business are largely mythical. Here is the story of what two plants do with their money—where it is distrihuted, and how much is left for profite to the manufacturer and his stockholders.

THE industrial benefits of the Army's expansion program are reaching down into every American community. Protests from midwestern towns to the contrary notwithstanding, these communities, too, are reaping their share of the work and contributing their proportion of the raw materials. An order to an industrial concern in Hartford or Seattle seldom means that the work will be done in that particular city. On the contrary, it is more than likely that only a fraction will be done locally. Nor does it mean that management will derive the greatest gains. Statistics from typical organizations in the aviation industry tend to prove that labor, raw materials, and engineering costs take up the largest part of the aviation dollar.

AVIATION MAGAZINE has reached these conclusions after a study of two typical organizations in the aviation industry—the large Boeing Aircraft Company in Seattle, which on August 30 received a War Department contract for 277 of its famous heavy bombing airplanes, the Flying Fortress, costing $70 449,955 20, and the Beech Aircraft Corporation, of Wichita, Kansas, which was given an award on August 28, 1940, for 150 training airplanes and 20 transport airplanes at a cost of $4,847,217.25.

The charts in this study clearly indicate that the size of the corporation merely affects the extent of the job done in places other than the parent home of the company. The distribution is practically the same.

Let us consider several features connected with the construction of the Boeing Flying Fortress. The geographical sources of raw materials used in its construction extend from Seattle to practically every state in the Union. The list of subcontractors and their addresses, illustrates the same trend, for it indicates that plants everywhere are being mobilized to meet America's military needs in the industrial field.

The chart showing the distribution by manufacture of money received for aircraft during 1939 by the Beech Aircraft Corporation is especially instructive. It shows that the plant had a gross income of $1,300,000, yet the stockholders received nothing. The power plant builders got 20 percent, labor 16¼ percent, engineering 10 percent, raw material 7 percent—everyone profited but those who made the capital investment. Is there better evidence than these facts to indicate that manufacturers are not gouging the public and are not piling up excessive profits?

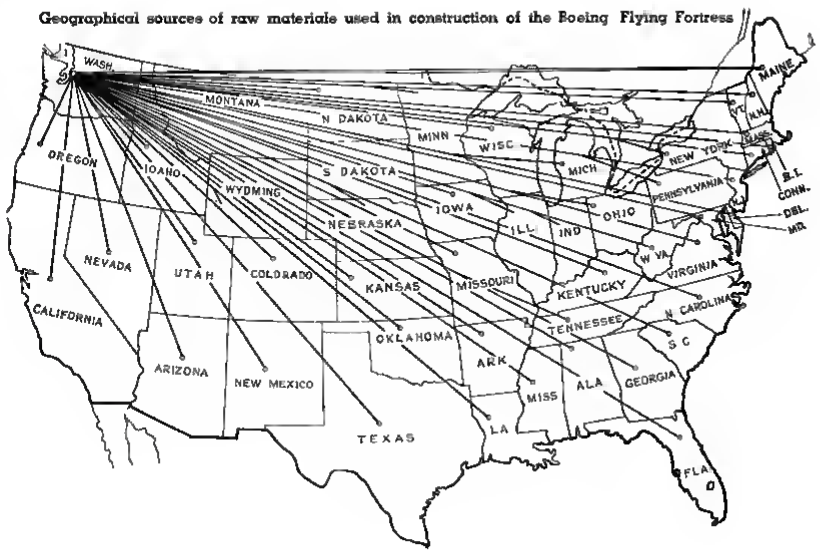
The national distribution of funds received in buying finished and raw material on the $619,000 spent by the Beech Aircraft Corporation in 1939, shows that 14 states in addition to Kansas contributed toward completing the Beechcraft model.

The chart showing the division of labor and wages paid during the year is also instructive in pointing out the different types of employment called for in aircraft production. This Beechcraft job called for aircraft assemblying mechanics, engine mechanics, sheet metal workers, machinists, tool and die makers, painters, upholsterers, maintenance men, woodworkers, welders, and others. The mere mention of the trades also emphasizes the quality of skilled work demanded of aviation workers.

These charts so eloquently tell their own story that it appears needless to add anything further than to express the belief that a similar breakdown not only in the aircraft industry but in all those allied to the national defense expansion program, would indicate a similar trend.

National defense is indeed a national effort, both from an armament and from an industrial standpoint.

Geographical sources of raw materials used in construction of the Boeing Flying Fortress



National Distribution of Funds Received in Buying Finished and Raw Materials During 1939

Expenditures For Material During This Period $619 000

Beech Aircraft Corp

Ohio Received 10% of this Total for furnishing the following:

Tires
Wheels
Brakes
Flares
Brass Bushings
Door Locks
Window Hardware
Fiber Putteys
Landing Lights
Navigation Lights
Rubber Fuel & Oil Hose
Fuel Strainers
Bulbs & Lamps
Tubing
Electrical Cable
Terminals
Loom
Dural Fitting
Vacuum & Fuel Pumps
Wobbie Pumps
View Finders

Connecticut Received 27% of this total for furnishing finished products and raw materials as follow

Engines
Propellers
Oil Radiators
Landing Gear Motors
Exhaust Stacks and Elbows
Forgings
Gear Chain
Spring Steel
Bearings
Piano Hinge
Dome Lights
Gas Tank Caps

Kansas Received 9.8% of this total for furnishing the following finished and raw materials:

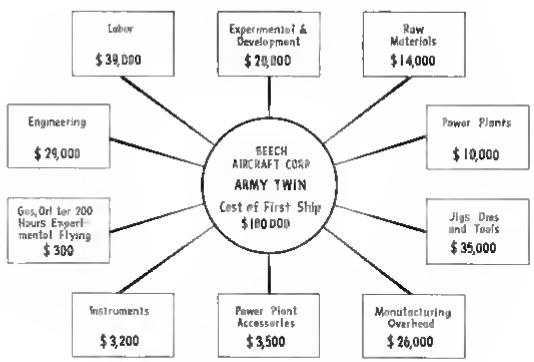
Clout Nails
Leather Strips
Bituminastic Paint
Identification Tags
Balsa Wood
Maple
Taxes paid to state
Cataloy Bronze Castings
Cotton
First Aid Straps
Cowl Fin Springs
Gasoline
Oil

Missouri Received 2% of this total for furnishing the following finished and raw materials:

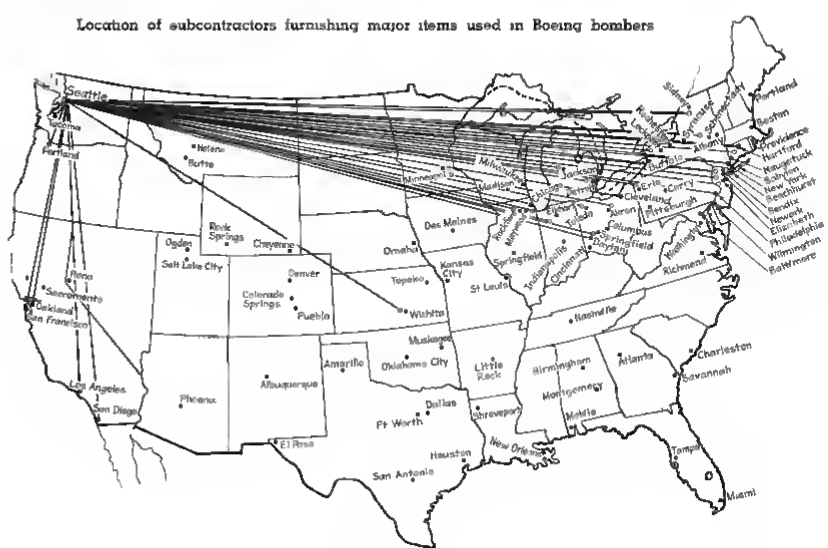
Stainless Steel
Fire Extinguishers
Thread and Rib Cord
Control Cable

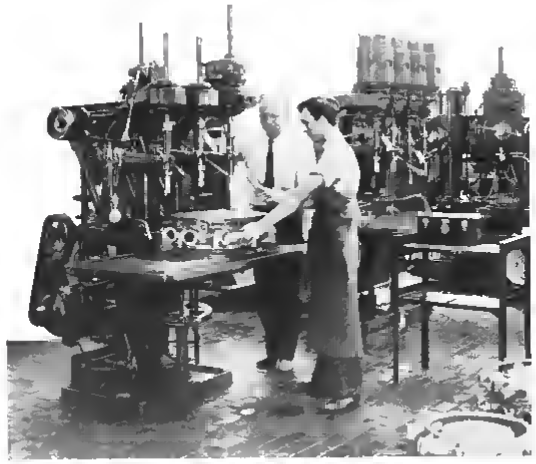
(*Turn to page 104*)

COST OF CREATING NEW OR SPECIAL TYPE AIRCRAFT



Location of subcontractors furnishing major items used in Boeing bombers





This scene at Pratt & Whitney Aircraft is typical of others taking place in all aircraft and engine plants as old-timers teach young men how to do a job.

Factory Training In The East

The National Defense program will call for a five-fold increase in men for aircraft and engine plants. Where to get these men and how to train them is a major problem.

By Carl Norcross *Assistant Editor, Aviation*

WANTED 300,000 men! That is a sign that might be hung outside the door of aviation factories and their subcontractors these days. According to aeronautical experts on the Knudsen Committee, the complete program for air defense will call for a three-fold increase in plant expansion and a five-fold growth in direct labor force. That there has been a shortage of experienced men for the past year is something that every employment manager will tell you. Now that every factory is about to start production on an unprecedented scale, the greatest man hunt in aeronautical history is about to begin.

It is no longer possible to get experienced men—that is, men who have had practical experience doing the particular job for which they are needed. They have all been at work these many months. As a result of this shortage, employment managers are combing the market for two types of workers: those who have had related experience of some sort who can be fitted into aircraft or engine work without too much difficulty, and youngsters who have had little or no work experience but who have had elementary training which is of value.

The entire burden of the 300,000 new men will not fall on the aircraft and engine plants, because the amount of work being sub-contracted is growing steadily. But since major plants and sub-contractors are often in the same general area, the number of available men must be shared, and the greatest pressure is upon the plant that completes the engine or plane.

The Personnel Manager is an important man these days. Along with the factory superintendent and the production manager, he is playing a vital role in the success of every plant that is working under forced draft. Filling orders is far more than having a good prototype, and a well equipped factory. It is men who make the wheels go round. And the difference between success and failure in a plant may rest squarely on the shoulders of the personnel manager and how far-sighted he may have been in choosing and training his men.

While the aeronautical industry is scattered throughout the country, the greatest concentrations are in two areas: southern California and an area within a 200 mile radius of New York City. This article is a brief review of aviation training problems in this eastern concentration, while the California area will be covered in a later article.

The critical personnel problem which airplane plants face is typified by the Republic Aviation Corporation at Farmingdale, Long Island. Located in a small country town some 30 miles from New York City, this factory now employs about 2,300 men, half of whom have been employed in the past year. Within a year, this one plant may well have 10,000 men. The problem that personnel manager Phil Shays faces in securing 7,700 men would be difficult enough were there no other aircraft or engine plants within a thousand miles. But he is competing for men with almost a dozen other plants making airplanes, engines, instruments or accessories—each of which wants men with practically the same kind of basic abilities.

Mr. Shays strongly prefers employees who live in his immediate locality. There are four or five towns in the vicinity from which he expects to draw help. He has found that men living in New York or Brooklyn are more likely to quit after Republic has trained them than are local men, as it is a natural tendency to want to work near home.

To get trained men the company has a choice of several methods. It could set up a school of its own, where new employees could be given intensive training in various kinds of sheetmetal and assembly work. It could pay a private aviation school nearby, which is operated by former Republic employees, to train its men. A third method could combine one of these plans with the use of an N.Y.A. school which is operating at Huntington, Long Island. After considering all angles Republic officials have decided to use public schools wherever possible, with the loan of equipment and instructors, but to rely heavily on the privately-operated sheetmetal school. The company will pay tuition for men it approves and courses will run from two to four months.

Courses at this school will be broken down into small units and men will learn to do sheetmetal or assembly work on the part of the airplane to which they will be assigned when on the job. The school now has about 200 students but will be able to enlarge considerably.

At Grumman Aircraft, located only a few miles from Republic, at Beth Page, the training problems are similar. Grumman has been a relatively small, closely-knit organization with an excellent reputation for providing its men with steady work. It has had almost no turnover in recent years and foremen and department heads have done their own interviewing for employment. Now, with huge orders on the horizon, it sees the need for employing many new men.

Grumman officials are working closely with a central district high school at Floral Park where men are being trained under the national defense training program. Six Grumman employees have been loaned to the school as instructors. The school teaches sheetmetal work, riveting, hammer work and welding. No funds were available for buying welding equipment, although the school had approval to rent such equipment. Consequently the company bought 15 welding torches and rents them to the school. Seventy-five men are now taking the eight weeks welding course, and a large group is in each of the other classes. No strings are attached to the men, and Grumman does not promise to employ them. However, the training has been excellent and the company looks forward to receiving many of its new men from this school. Lawrence High School, in another community near Grumman, has 75 students studying aeronautical subjects and some of this group should qualify for employment. There is a possibility that under the auspices of the New York State Education Dept. a school for aircraft mechanics may be established this year on Long Island and if this is done, all Long Island factories will benefit. In addition to this training, given outside the plant, Grumman uses its lead men and supervisors to break in its new employees.

Brewster has a dual problem to solve because it has two plants in two different areas, one in Long Island City and another at Newark airport. The latter is strictly an assembly plant, and as such it can put to good use the graduates of such nearby private schools as Casey Jones and Clarence Chamberlin. The factory has employed students from all the private schools in the vicinity as well as from several public schools.

Brewster is fortunate in that it is the closest factory to two high-class public schools that have aviation courses: the Manhattan High School of Aviation Trades and Brooklyn Technical High School. The former is the largest all-aviation public school in America, having a three-year course and accommodating some 3,000 students. The school is run by practical men, and its graduates have gone to every factory in the east. It is natural,

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Throughout the country youngsters and adults are learning sheetmetal work through national defense classes in our public schools in order to help the aircraft industry meet production schedules. Photo from Manhattan H.S. of Aviation Trades

A Republic pursuit ship built for export, nears the end of the assembly line. Many well-designed jigs have speeded its construction.

Jigs at Republic

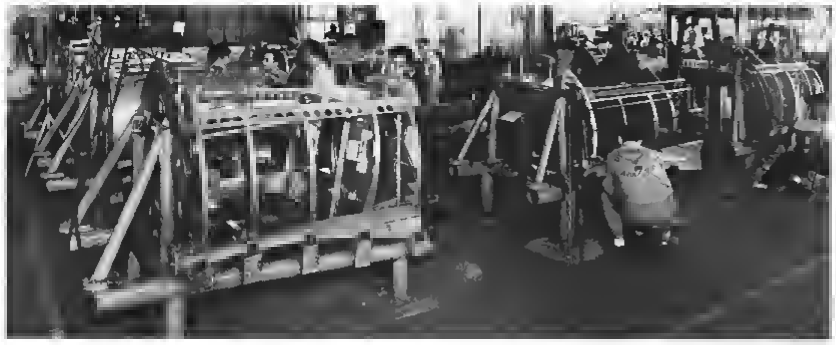
When a small plant grows into a large plant, its engineers use every possible means to speed production by the development of efficient jigs

THE Republic Aviation Corp. at Farmingdale, Long Island, is speeding production on pursuit planes these days by using jigs wherever possible throughout the factory. Its engineers have accepted the doctrine that the greater the number of unit sub-assemblies into which a plane can be divided, the more jigs can be used, the more men can be employed on fabricating and assembly operations, and the faster will planes roll off the assembly line.

Each Republic plane is divided during manufacturing into fuselage and wing groups. The parts of each group constitute a major sub-assembly—front, middle and tail sections for the fuselage, and center, outer left-hand and outer right-hand panels for the wings. These are built up from minor sub-assemblies such as spars, ribs, bulkhead or frame rings, longerons, stiffening ties, leading and trailing wing edges, flooring, stringers and skin.

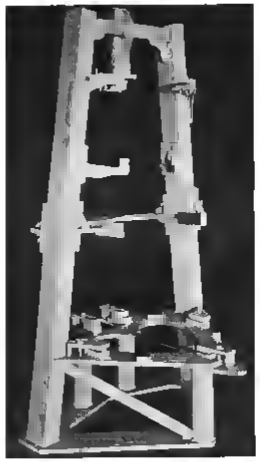
Outstanding features of the jigs are the small number of fastening points required, and the use of bolts and dowels to hold parts during assembly. Jigs for all major parts are imbedded in the concrete flooring. They are built and maintained by expert toolmakers. Accurate jig alignment makes possible close precision fits during assemblies.

The front fuselage section is assembled in an L-shaped jig. Firewall and bulkheads previously assembled on other jigs, are bolted in place. Then longerons are added, then brackets, flooring and accessories. Finally pre-drilled skin is riveted.



Mid-section of fuselage is made in left and right-hand halves, split longitudinally, both halves being in this jig. Bulkhead rings are fastened to jig, then stringers, horizontal stiffeners and skin are added. This arrangement gives mechanics plenty of room to install flooring, brackets and fixtures for radio and electrical equipment.

Right. Next step is to remove two halves of mid-section and fasten them together in this upright jig.



Above. Tail section of fuselage is made on these jigs. Four bulkhead rings are first attached, which are used to locate and hold four bridges or ties. Then circumferential stringers, tail-surface and tail wheel attaching brackets are secured before skin is applied. Left: close-up of tail-fuselage jig. Below: After three fuselage sections are sub-assembled, they are spliced together. Attaching points are at end and middle of tail section, at center of mid-section and at two points in front section. Angle-iron brackets, some pivoted and some rigid, are mounted on jig columns to form attaching points. Note how skin is staggered to avoid strain at splicing points.

More Jigs at Republic

Five spars run through each wing panel. They are assembled in these jigs which hold a built-up web between top and bottom flanges. Bottom flanges rib angles and webs are drilled through holes which are jig drilled in top flanges and angles

This rudder jig is typical of those used for control surfaces. Jigs rest firmly in concrete, are solidly made. Engineers have studied each jig to provide quick, accurate assemblies. An outstanding feature is the small number of fastening points.

Leading edges of wings are jig assembled from spars, press-formed nose ribs and templet cut skin. The ribs are lined up vertically by taut wires. Spars rest on jig brackets, then rib-attaching angles are riveted. Skin is pre-drilled.

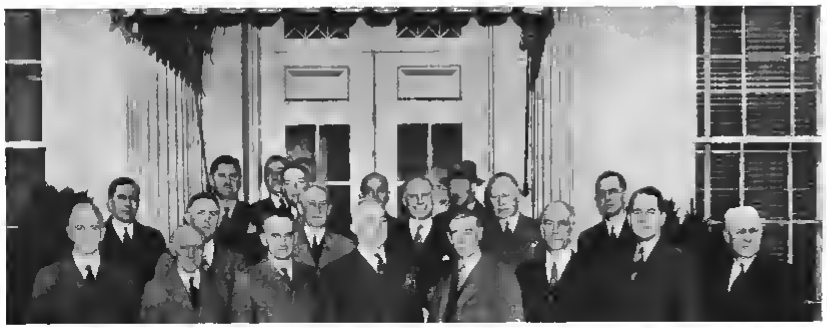
Longerons which carry engine-mount reactions into the front fuselage section are jig assembled from press-formed sections, flat web sheets, tapered side panels and extruded angles. Pick up holes are drilled to start the assembly

Wings are made up of a center section, left and right-hand outer panels, and tip sections. On these jigs the two outer panels are assembled. Each jig has five vertical members, the center member being the dividing point between the two halves.

Entire floor sections are made from corrugated, flanged and press-formed sheets. These are placed between the angle frames of the jig preparatory to drilling and riveting flanges and stiffeners. This is but one of the many special-purpose jigs.

Wing tips are assembled in jigs with fastening brackets around the edges and angle irons at outer panel splice. During assembly the top skin, ribs and bottom skin are applied, each being drilled and riveted. Skin is dimpled for flush rivets.

Fuselage bulkhead or frame rings are assembled on benches from circular flange sections set in attaching brackets around the perimeter of their jigs. Web sections and stiffening angles are bolted in place for drilling, reaming and machine riveting



The National Advisory Committee for Aeronautics calls on the President at the White House on its 25th anniversary, April 18, 1940. Front: l. to r.: Lyman J. Briggs, Robert E. Doherty, George J. Mead, Maj. Gen. Henry H. Arnold, Dr. Vannevar Bush, Charles G. Abbot, Edward Warner, Brig. Gen. George H. Brett. Rear: l. to r.: S. Paul Johnston, John F. Victory, Clinton M. Hester, Capt. Sydney M. Kraus, Rear Admiral John H. Towers, Orville Wright, Francis W. Reichelderfer, Robert H. Hinckley, Jerome C. Hunsaker, Dr. George W. Lewis, Edward H. Chamberlin. Dr. Bush is chairman of the NACA and also of the new NDRC.

RESEARCH GIRDS FOR WAR—Part II

Only through research can this country keep ahead of the aeronautical procession. Here is the story of the National Defense Research Committee

By S. Paul Johnston, *Coordinator of Research, N.A.C.A.*

Editor's Note: Part I of this article dealt with N.A.C.A. while this section deals with the new N.D.R.C. and how it operates.

FOLLOWING the organization of the National Defense Research Committee by President Roosevelt last June, some of the best scientific brains of the country were mobilized and are now at work formulating programs.

First to be called was Dr. Vannevar Bush, president of Carnegie Institution of Washington and chairman of the National Advisory Committee for Aeronautics. Dr. Bush has a long and distinguished career in research and engineering behind him. As chairman of both NDRC and NACA, Vannevar Bush becomes the High-Priest of research in the United States, a key man in the armor of the nation's defense.

Time was when the record of the part played by civilians in warfare was small. Important as their contributions may have been, they have always been overshadowed by the generals and the admirals who held the center of the stage. The man in uniform was the man of the hour.

But the introduction of completely mechanized warfare is changing this picture. Soldier and sailor on active duty in the field or at sea become for the most part military crews that operate the war machine. The efficiency of that machine depended on the skill of the designers and the engineers, both civil and military, who conceived it and who built it. For years the Army and the Navy have been cooperating with industry in constant development of newer and better weapons. Too much credit could not be given to the technical personnel of our fighting services for their contribution toward the efficiency of our fighting machine. The new National Defense Research Committee in no sense replaces or absorbs any of the functions that have been carried out by the technical branches of the services. It is set up to provide them with the coordinated assistance of the civilian research worker in all scientific fields. It is working in the closest sort of cooperation with both sides of the house and practically all that it accomplishes will be reported in confidential form to the proper personnel of the armed services.

The new committee deals in that intangible commodity which we might call "know how." Its primary function is to provide a link between the worker in the research laboratory who is constantly developing new ideas and new ways of doing things, and the practical man, both in the military services and industry, who is charged with translating the "know how" into the weapons and material for national defense. Our scientists must keep our engineers and manufacturers up to the minute on their technical information.

It takes no great stretching of the imagination to see that the fate of any nation may well depend on effecting organization of its research efforts and on the ability of its research men to get the right answers at the right time. Tomorrow's battles are being won or lost today in the quiet backwaters of the country's scientific and industrial laboratories.

Fortunately, no one is in a better position to realize this fully than is Dr. Bush. Even if his general background had not acquainted him with these facts, his work with the National Advisory Committee for Aeronautics would have done so. Because of its outstanding position and accomplishment in the aeronautical field, this 25-year-old organization was used as the pattern on which the new and broader research committee was based.

The NACA was established as an advisory committee to the Army and Navy before we entered the last war. Its purpose was to keep our military services posted on how to improve our fighting aircraft. It was soon discovered, however, that the committee could not advise properly without undertaking some research of its own. From very modest beginnings the NACA has built up an aeronautical research plant at Langley Field which has become a model for aircraft investigational establishments all over the world. It now represents an investment of over $12,000,000. It employs a staff of 750 technicians. Its primary function is to provide the necessary tools with which the engineers and designers who build our commercial and military aircraft do their work. It is safe to say that the achievements of such people would have been immeasurably more difficult, certainly more costly in lives and in money, in many respects impossible, without the fundamental data that have continuously been poured out of the laboratories at Langley Field.

It became plain in the past few years, however, that we were lagging behind Germany in building up and maintaining our research plant. Recognizing this deficiency, the Congress authorized an extension of laboratory facilities, not only at Langley Field but including also the beginning of a new aeronautical laboratory at Moffett Field, California, now known as the Ames Aeronautical Laboratory, named in honor of Dr. Joseph S. Ames, who long served the committee as its chairman. In addition, an appropriation of $8,400,000 has just been made for the establishment of another laboratory for the specific purpose of investigating engine and power plant problems. At the present time a small amount of engine research is conducted at the Langley

All research is not done in laboratories. An icing experiment in flight with an NACA airplane. Water sprays are carried on the outriggers ahead of the wing and ice is formed on an experimental de-icing boot.

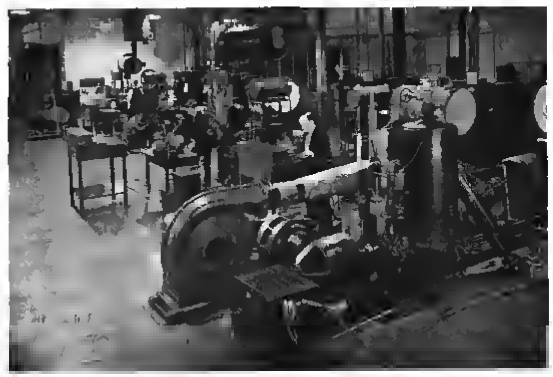
laboratories, but there is a growing need for expansion of facilities in the power plant field to keep up with the expanded programs for aircraft design and production now under way as an essential part of our national defense. Work is now well under way on this project.

The NACA is an independent government agency. The committee itself is made up of fifteen outstanding individuals who serve without compensation. Nine of these men serve on the committee by virtue of their offices—including the chief of the Air Corps, the chief of the Materiel Division of the Army, the chief of the Bureau of Aeronautics and the chief technical officer of that Bureau, of the Navy Department, the chairman and the administrator of the Civil Aeronautics Authority, the director of the National Bureau of Standards, the chief of the Weather Bureau, and the secretary of

(*Turn to page 118*)

Entrance to the working chamber of 19-ft. pressure tunnel is through an air lock.

General view of the engine research laboratory.



Curtiss Propeller Production

Part II

This second part of the production at the Curtiss Propeller Division includes a description of manufacturing their now famous steel bladed propeller, a great contribution to aviation.

THE first section of this article was devoted to the production of the aluminum alloy blades all of which work is done at the Curtiss Propeller Division of the Curtiss Wright Corporation, Clifton, N J Here also are manufactured the steel hubs for these blades as well as the hubs for the hollow steel blades In the following continuation of the story, the various general departments are described, including a description of the method of producing the hollow steel blades.

The Machine Shop

The machine shop is not limited to production of parts for any one section of the propeller but instead does some production for every department For example, it makes hub and blade gears speed-reducer gears, speed-reducer housings, power gears, adapters on the front of the propeller to hold the power unit in place motor housings, and brush housings which are fixed on to the nose of the engine to hold the brush at the rear end of the propeller To carry out all of these varied functions, the machine shop has been designed so that each individual machine can be switched over to do any one of a number of jobs

The machine shop is located in a large building separated from the main section of the plant Inside are located several production lines each taking care of its own type of work For instance, there is a line of Gleason gear cutting machines (Fig 18) which are used solely for the operations requiring close tolerance in the forming of gear teeth Another typical line consists of a number of gang drill presses the heads of which can be arranged so as to drill a great many holes at one time in any desired pattern Then there are grinding machines lathes, individual drilling machines, and a section devoted to work benches upon which the workmen can perform individual operations

In one corner of this building is located the heat-treating department Into this come all of the parts from the various production lines that require a heat-treating operation The shop is also capable of Nitroloy hardening gears and other parts that require such hardening

The flow of production out of the machine shop goes to almost every other department in the plant Those parts that are finished pass through the necessary inspection departments and then are placed in the Finished Stores Some finished parts go directly to the sub-assembly department, and the unfinished parts go back to their respective production lines

A section of the Curtiss Electric Propeller plant of the Curtiss-Wright Corporation located at Clifton, New Jersey The company has increased its manufacturing facilities from 17,000 square feet to about 220,000 square feet in the last 22 months by expanding several times its plant at Clifton, by purchasing late in 1938 the Pittsburgh Screw and Bolt Company's Hollow Steel Blade Corporation in Pittsburgh and is now doubling its facilities by constructing a modern factory of about 230 000 square feet at Caldwell, N J.

Fig 15. A double headed Hydro Tel machining the hub.

Fig 16 Grinding inside of hub barrel on Bryant Grinder

Fig 17. Hub barrel inspection with go and no-go gages.

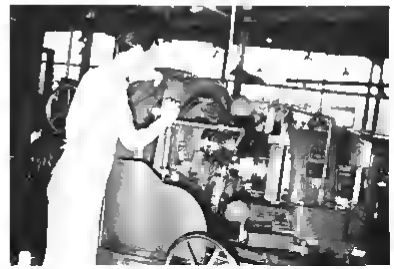


Fig. 18 Cutting Spiral Bevel Power gear on Gleason Cutter.

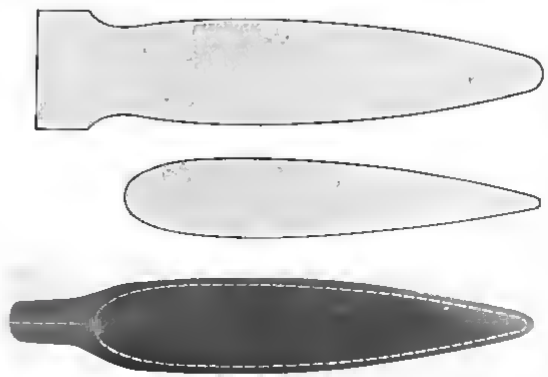


Fig 23 Each hollow steel blade is made of two sections. One section, shown at the top, forms the curved part of the blade as well as the shank. The edges are rolled over and the remaining section, shown in the middle drawing, is welded in place by a special process. The resulting blade in general takes the form shown in the lower photograph with the weldings along the dotted lines The weld is so perfect, however, that after machining and finishing on side of the weld is on the outside of the blade

Cuff Department

The newly designed Curtiss propeller cuffs are made in a separate section of the main building The castings for these cuffs are magnesium and when these castings arrive they go through the regular routine of receiving inspection, then to the Rough Stores department from which they are requisitioned to enter the production line The skin of the cuff is fabricated outside of the plant and is made nearly its exact shape Each cuff is fitted to a specific blade This cuff can be removed, however but it will not necessarily fit any other blade when it is once formed

Sub-Assembly Department

The sub-assembly department is located in another building entirely separate from the main section of the plant In this building is also located the research department and the engineering department on the second floor The sub-assembly consists mainly of the assembly of the power unit which controls the pitch of the propeller blades The work that is done on those

(*Turn to page 110*)

American Airlines Trains Its Rookies

Over 200 men and women are always in training at American's base at LaGuardia Field

THE recent scurry to train young people for work in aviation is a new project for the public, but for companies actually engaged in the business it is just the same old problem they have been facing and solving for years.

Because air transportation was and still is a comparatively new business, aviation officials long ago discovered that to have efficient employees, some provision in the industry has to be made for training.

For example, American Airlines, Inc., found that experience in other lines of work is beneficial as a background to the man or woman who wants an aviation job, but that further special instructions, experience, and training are necessary.

A-1 salesmen are needed to sell air transportation, make reservations, and contact passengers, but they need to know more than just how to sell and meet the public. These sales people also need to know the problems of air transportation and how it works—in order to answer all the questions they are asked.

In other words, aviation turns out to be another specialized line of salesmanship for the agents.

This same principle, American Airlines discovered years ago, applies to its pilots, stewardesses, engineers, mechanics, radio operators, ticketing and reservations agents.

The result was that to make the progress required of a new industry, American Airlines became a leader in setting up special training schools for all its employees on salary, at its own expense.

One of these is the school for pilots with 800 hours flying time in Army, Navy or Marine Corps. Other flyers with 1000 hours in commercial work are acceptable.

They have to have almost perfect eyesight and hearing; they are between 21 and 28 years of age, between 5 ft. 8 in. and 6 ft. 2 in. in height, and weigh between 140 and 200 lb.

Generally they have at least two years of college training or the equivalent, and they have a radio-telephone license as well as a commercial instrument rating.

A man who meets all these requirements before he even enters the school is a flyer of extremely high caliber.

After he is accepted for training in American's school, Capt. William B. Lester, chief instructor, directs the man in his further studies for six weeks at LaGuardia Field, New York City.

Generally this school, which goes on continuously, has about 30 pilots enrolled. Graduates are assigned to jobs on American's giant Flagships as first officers. They may advance to the rank of captain after certain satisfactory experience which includes periodic examinations that require them to remain physically perfect, especially as to eyesight and hearing.

One of the unique features of the pilots training school at American is the Link Trainer. This is a small hooded cockpit in the classroom in which the pilot flies on instruments. The pilot receives instructions "by radio" from his teacher seated at a nearby desk before an instrument which records the flight while the Link Trainer maneuvers as though it were actually in the air.

One of the things which new men generally have to learn in the school is to fly smoothly for passenger comfort on a scheduled flight at given speeds and altitudes. Experience in other types of flying does not often stress these requirements in commercial air transportation.

Several times each year Miss Hazel Brooks, director of stewardess instruction, holds a seven-week school at LaGuardia Field. Generally the class consists of about 30 registered nurses who have had possibly a year or two experience in their profession after graduation.

The idea is that an attractive girl who must meet and serve the public while aloft is best fitted for her job if she has had the discipline and training that one receives as a nurse.

Applicants for the stewardess school are between the ages of 21 and 26, between 5 ft. 3 in. and 5 ft. 6 in. in height, and between 105 and 120 lb. in weight. They must not be married or object to being transferred to bases where they are needed.

One of the finest things about the job is that the stewardess cultivates her ability to talk with people whom she has just met, an asset to almost anyone in any walk of life.

In the stewardess school the girls study the following subjects: (1) Maps of the major airlines, including all the stops made by each line. (2) The parts and construction of a plane, what makes it go and what keeps it in the air. (3) Flight control, radio, communications. (4) Aviation meteorology, ticketing and reservations, food service. (5) Duties of a stewardess.

Experts in American Airlines explain to the class each of these divisions of subject-matter and give demonstrations in the plant. During the latter part of the school each girl is sent on flights in order to observe procedures and become accustomed to her duties. She is drilled carefully in each task that she will perform. And like the reservations agent, the stewardess must be able to answer the many questions in reference to flying that passengers ask, for stewardess service does as much as almost any other thing to sell the public on air transportation.

All operations and sales agents are put through a course of reservations, ticketing and salesmanship before being assigned to a job. On the opposite page are members of a recent class.

Miss Hazel Brooks, who directs stewardess training with a class of registered nurses who will soon be out flying the lines.

Another school maintained by American is a class for operations and sales agents. At LaGuardia Field several groups of approximately 50 young men have gone through a training of six weeks together.

T. W. Brooks, supervisor of stations, is in charge of the operations division of the school, and Howard Kurtz, supervisor of reservations and ticket offices, the sales group.

During the first four weeks the 50 men study history of air transportation, what services it makes available to the public, the organization of American Airlines, Inc., and the general subject of passenger service. This includes reservations and ticketing, telephone technique, and salesmanship. At the end of four weeks the sales students are sent out on assignments to reservations and ticket offices wherever they are needed in the system.

Operations students during another two weeks of classroom study go into flight control, clearance of aircraft, meteorology, weather observations and reporting, as well as handling of cargo which includes passenger baggage, air express, mail and company shipments.

After graduation they go out to assignments as junior agents for experience and further training on the job.

A fourth school, for apprentice mechanics, is directed by T. J. Healey, supervisor of apprentice mechanics. This course covers a period ranging from two to four years. It is approved

(*Turn to page 126*)

Apprentice mechanics get a thorough schooling under close supervision. This mechanic is assembling a carburetor air scoop after engine has been overhauled.

All photographs from American Airlines

New copilots spend six weeks in school during which they put in many hours of instrument flying in the company's Stinson. Instructor sits on the right. New pilot is completely shielded from the view.

Northrop Wind Tunnel

Wind tunnels are being built by almost every large airplane manufacturer. Northrop has one of the largest having a 12-ft. throat.

By Eldon Wilson, *Wind-tunnel Project Engineer Northrop Aircraft, Inc*

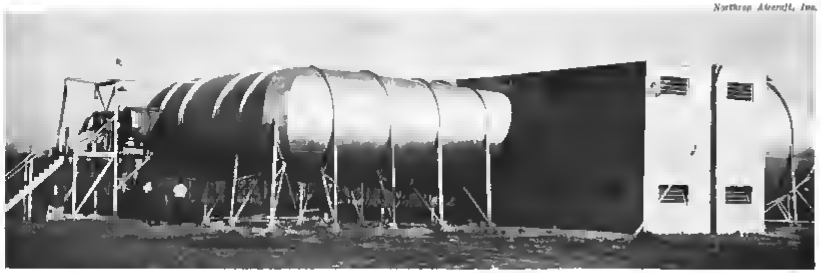
FACED with crowded test schedules at the only two wind tunnels on the Pacific Coast, the Guggenheim Aeronautics Laboratory tunnel at California Institute of Technology, Pasadena, Calif., and the tunnel operated by the University of Washington Aeronautics Laboratory at Seattle, Northrop Aircraft, Inc., has designed and built and now has in operation its own wind tunnel. This is one of the largest private wind tunnels in America, and is believed to be the first large wind tunnel to be placed in operation by any major aircraft manufacturer in this country. Provision of this tunnel has made possible immediate tests relating to an intensive and uninterrupted research program.

Eldon Wilson
Wind-tunnel project engineer

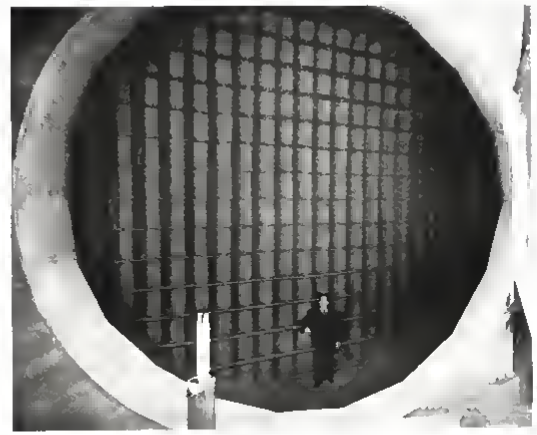
The Northrop tunnel is of the same size as that at Cal Tech. It was designed by the Northrop engineering department under the direction of Dr. Theodore von Karman and Dr. William Sears, of the California Institute of Technology. It is of the return type and is constructed of electric welded sheet steel with reinforcing and support members of structural shapes, mounted in concrete. Actual construction was done by the Acme Pipe & Blower Co., Los Angeles. The largest section of the tunnel is 35x22½ ft., with the average size 22½ ft. in diameter, narrowing to a 12-ft. throat in which the model is mounted.

The working section is housed in a two-story laboratory 25x40 ft. in floor plan, and 20 ft. high. Just below the lower wall of the test section there is a working platform from which inspection adjustments or installation of models can be made. The working section is of wood construction, having large curved glass windows in each side. This part of the tunnel is hinged along its top center line and each half opens out and upward giving an unobstructed space for working on the model. Below and extending up through the platform is the balance mechanism which was designed and built at Northrop. Forces

Northrop Aircraft, Inc.



The Northrop tunnel is one of the largest privately owned tunnels in the world. Of the return type it is built of sheet steel electrically welded to steel girders. The tunnel interior is ground and polished to a glass-like finish. In the view above the smallest section is shown with part of the large section just visible to the right of the two-story laboratory. Power is supplied by a 1 200 hp. Wright G200 series Cyclone engine and is transmitted through a fluid drive coupling to twin propellers of 15 ft. diameter. The engine installation is on a separate foundation (extreme left) to prevent engine vibration being transmitted into the tunnel proper.



This view shows the largest section of the tunnel which is 35½ ft. wide by 22½ ft. high. This view was taken up-wind from the tunnel throat. For comparison in size one of the Northrop technicians posed beside the vanes that control the air flow. These vanes are adjustable to get the desired results.

are measured on six Toledo scales simultaneously from one position by the operator, who can lock the scales for a reading at any desired point. Changes in pitch and yaw settings during the test runs can be made without shutting down the air flow or removing the model from the tunnel.

The model is suspended in the tunnel by a method of rigging similar to that used at the University of Washington, except that all forces on the model are measured independently by mechanical means, instead of the electrical mechanism used at Washington. This method of suspension permits tests and measurements of lift, drag, side-force, pitch, yaw, and rolling moments at the same time.

The model is fastened on forks which are enclosed in individual streamlined housings mounted on MRC sealed ball bearings which permit the housings to float, thus they always have their narrowest section towards the slipstream regardless of the yaw setting of the model. This design eliminates side forces other than those acting directly on the model.

The model support forks terminate on a flange approximately half way from the model to the tunnel wall. The flange is drilled for attachment of various support forks as required by different models, and is welded to the yaw tube. That portion of the yaw tube extending from the tunnel wall to the fork flange is enclosed in a streamlined housing 4 in. wide by 14 in. long, which in turn is fastened to the moment tube. This streamlined section also is directly upstream and never turns, thus eliminating aerodynamic disturbances which would give erroneous readings and have to be compensated for.

Frictionless universal action of the Northrop balance system is gained by the use of a flexure pivot tripod similar to that used at the University of Washington, except that the tripod itself is mounted outside the tunnel and a special replaceable flexure joint is provided as developed by Northrop. The upper end of the tripod is fastened to the moment tube and the lower end to the force tube. The force tube in turn is mounted on a parallelogram support, using flexure universals throughout. Thus motion in every direction is possible and each force can be read directly on the Toledo scales without having any of the six forces interfere.

Pitch and yaw are controlled by Dumore electric motors which may be actuated while the tunnel is in operation. A dial calibrated in degrees permits the operator to read directly both the angle of pitch and yaw.

With this system of model suspension a test or series of tests can be completed more rapidly than heretofore largely due to the ease with which the model can be mounted and the rapidity with which test data can be recorded. While this cuts test costs appreciably, the important factor is the speed-up of testing which shortens the period between design and production.

Designed for much higher pressures than will be used at present, the tunnel will provide greater testing speeds at a later date through the provision of more power. Present maximum speed is approximately 160 m.p.h. in the test section, obtained by use of a Wright Cyclone G200 series engine of 1 200 hp. mounted outside the tunnel and driving the 15 ft. propeller by means of a 22 ft. drive shaft. A special fluid drive coupling insulates the drive shaft from torsional vibration of the engine. This results in a smoothness of drive comparable to that obtained with an electric motor. The drive shaft is mounted on three Fafnir self-aligning expansion type pillow blocks, adjustable in every direction for shaft alignment. The special propeller was built by the Storey Gawley Propeller Co., Glendale, Calif., and consists of two two-bladed propellers mounted at right angles. Downstream from the propeller is a straightening vane assembly, installed like the spokes of a wheel, but with airfoil-shaped vanes having adjustable trailing edges. These vanes straighten the air flow from the propeller.

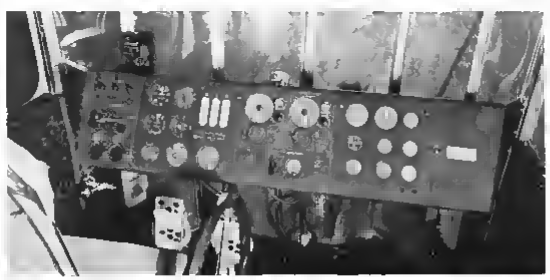
Engine cooling is provided by air from the tunnel itself bled through a duct to the engine cowling. This produces a circulation of air in the tunnel which completely changes air every two minutes and keeps the temperature of the tunnel air constant without provision of cooling apparatus. Air enters the tunnel at the downstream edge of the working section through a radial slot, thus permitting the model to work at atmospheric pressure.

Comparative runs are now being made to standardize the Northrop tunnel with other wind tunnels of the country. Routine testing will shortly be under way, permitting substantial acceleration in the pace of Northrop's research program.

BLIMPS

You've seen these blimps floating jauntily about in the sky. This is the story of their successful operation over more than a score of years.

By R. G. Picinich, Jr.



Upper left forward portion of the airship Enterprise. Front left seat is occupied by the pilot, front right seat by copilot or by the operator of the flashing electric signs. Lower left: each segment of the sign fastened to the outside of the blimp can flash any letter in the alphabet, or any figure. Power for the Neon signs is provided by a special generator operated by one of the two engines. Each letter is tested before ship takes off. Upper right: Neon signs are operated during flight by a tape fed through a special machine. The tape is prepared before a flight by being perforated on this code machine which operates like a typewriter. Lower right: instrument board of the Enterprise. Lower left and upper right photos by Rudy Arnold.

AMERICA, primarily because of the war emergency, is becoming a nation of air-minded individuals. What the government is doing today to interest its citizens in the art of flying, the Goodyear Tire & Rubber Co. has been doing in a lesser degree for the past two decades, quietly and without fanfare—but with worth-while results.

A fleet of Blimps, stationed at population centers throughout the nation, has introduced 367,683 persons to this pleasant and educational pastime. Passengers have been carried for a distance of 3,724,129 miles without a single fatality, and in setting this record the airships made 137,267 flights.

The company had a three-fold purpose in inaugurating this service—to make Americans air-conscious, train personnel for both civil and war requirements, and to experiment with and improve equipment and materials.

Since this is a story of the Blimp, the non-rigid, lighter-than-air ship, let's start by making clear how it differs from the heavier-than-air plane. The principal difference is in the source of lifting power. The airplane is a dynamic craft, deriving power from its velocity alone, since the air pressure and suction on its wings give aerodynamic lift only as long as flying speed is maintained. The airship is aerostatic, that is, its buoyancy arises from the fact that the lifting gas is so much lighter than air that it will support, without other assistance, not only the balloon in which the gas is contained but the craft itself and the weight of crew, motors, fuel and pay load. The airship will remain in the air even though its motors are shut off, a big safety factor.

The non-rigid airship is really a balloon, shaped like a huge cigar to give it directability, and carrying motors to give it forward movement, which maintains its shape by means of the pressure of the gas it contains. The popular name, Blimp, is derived from B-limp type, the British designation during the World War to distinguish "limp" ships from rigid. An interesting feature of the non-rigids is an air-filled balloonet, built inside the cigar-shaped balloon with the result that, as the lifting gas expands, due to temperature or altitude, it forces air out of the balloonet, the gas being conserved. Conversely, as the gas contracts, more air is forced in from the slip-stream of the motors or by a blower.

Another essential difference between the airship and the airplane is that blind flying by plane may be hazardous, since control failure or an operating mistake by the pilot may send the airplane into a spin from which it may be unable to recover, whereas the airship is fundamentally stable and may fly through fog with impunity. Blimps can be sent out in weather where it is inadvisable to use airplanes.

Goodyear's lighter-than-air activity began in 1911, when the first specially equipped machinery for spreading rubber on fabric was installed. Its first Blimp was built in 1919 when a tiny hydrogen bag of 37,000 cu. ft., nicknamed the Pony Blimp, was completed. It was based in Los Angeles and demonstrated the possibilities of small aircraft. While the airplane had become by then a common sight, the only lighter-than-air ships were the army and navy ones, rarely seen by the public and then at a distance. The Goodyear Blimps came down out of the sky, mixed with the people of America, and slowly began to stimulate interest in this phase of aviation.

The present Goodyear Fleet began with the launching, in June 1925, of the Pilgrim, a 51,000-cu. ft.-capacity ship called "America's first air yacht," as the initial non-rigid to be built with a closed cabin. It was flown with the non-inflammable helium gas—as have the others since. In 1928 came the Puritan, a twin motored cabin ship of 86,000 cu. ft. Early in 1929 the Volunteer, Mayflower and Vigilant came out of the shop—then the Defender, 184 ft. long and with a gas capacity of 180,000 cu. ft., capable of carrying 10 passengers. The Reliance in 1931 and the Resolute in 1932, both of 112,000 cu. ft. capacity, were replacement ships to the Vigilant and Mayflower.

In christening the Blimps, President P. W. Litchfield of Goodyear selected names made famous by American Cup-defending yachts in the international races. Of the eleven ships with the fleet in the fifteen years, the Pilgrim has been in the Smithsonian Institute since 1932, the largest, the Defender, was rebuilt in 1935 for military purposes, and five are still in service—the Volunteer, the Reliance, the Enterprise, the Resolute and the Rainbow. The oldest, the Volunteer, completed ten years of active service on April 27, 1939, and is the only non-rigid to make a trans-continental round trip. Two ships, the Rainbow and the Reliance, are based this summer at Bendix Airport and carry passengers and advertising over New York City, skirting the World's Fair, and in nearby New Jersey. One ship each is stationed in Washington, D. C., and Akron. The Blimps are flown in Florida coast resorts during the Winter and have also operated at both the Chicago and Cleveland expositions.

The thousands of persons who have gone aloft have paid from $1 to $5 each. The low priced ride is of some 5-min. duration, one of 30 minutes costs $4 and where six people go up

(*Turn to page 120*)

Aviation Financial Outlook Improves

By Selig Altschul

ONEROUS as the new excess profits tax measure may be, the aircraft manufacturers, as indicated last month, will not be prevented from operating at profitable levels.

Final passage of the tax bill, moreover, may be expected to exert a constructive influence on aircraft securities. Ample statistical evidence clearly shows that there is precedent for low valuations being placed on wartime earnings which are threatened with increased taxes or other restraints. Actual realization of such fears, however, may well bring about a more normal relationship between stock prices and earnings. With leading aircraft equities continuing to sell at a low ratio in relation to anticipated earnings, even allowing for tax deductions, such securities are in a position to participate in any general market upswing.

This question of taxes is not so easily settled or forgotten. The fact remains that the present impost is expected to yield only about $485,000,000 or less annually. With expenditures of billions for defense in prospect for years to come, it is a natural expectancy that this tax bill is merely the opening wedge for still more substantial increases in corporate taxes in the future.

Yet vague prospects of higher taxes to come may not be sufficient cause for the financial markets to ignore sharply increased aircraft earnings indefinitely. As higher earnings are reported with attendant increases in dividend rates, sentiment in the financial district will, according to past experience, inevitably be affected. Long range factors, such as eventual tax increases or a post-war depression, several years hence may be helpful in rationalizing why present earnings ratios remain abnormally low for a time, but they do not actually determine speculative and investment behavior for any protracted period of time.

While it is true that the aircraft industry, at the termination of the present "emergency", will have a tremendous amount of excess capacity in plant facilities, it must be remembered that much of the present expansion is being developed on not unfavorable terms. Moreover, it is seldom indeed when relatively distant dangers of this character cannot be discerned on the horizon by the continuous investor. Bull markets, be they in aviation or in other securities, nevertheless occur whenever current earnings remain at a relatively high level for any considerable period of time.

The air transport companies appeared at a decided disadvantage when the earlier version of the tax bill was advanced. With the inclusion of an exemption, however, adverse effects on the industry's earnings may have been avoided. An amendment stipulated that the excess profits tax shall not apply to earnings from a route which is not self-supporting and which requires a subsidy. While the entire air transport industry, as indicated last month, with its low invested capital and rapid growth characteristics, would have suffered without this exemption, American Airlines appears to have avoided the heaviest tax assessment by the inclusion of this amendment.

Looking ahead, the air transport industry may, in the long run, be an important beneficiary of our current national defense program. The attainment of our military needs together with the passing of the rearmament program, will provide an overflow of plant facilities which may be conducive to low-cost transport planes. A large number of trained pilots will also be available for service in commercial aviation with the consequent effect on labor costs.

With completion of one full year of European hostilities, it is interesting to observe how aviation securities have acted during this period. Measured by BARRON'S averages, the aircraft group on August 30, 1940, was at 37.15, up slightly from the index of 36.10 shown on September 1, 1939. On the other hand, the air transport group rose about 82 per cent from 14.38 on September 1, 1939, to 26.12 on August 31, 1940. It is interesting to note further that the general market, as shown by BARRON'S 50 stock average, actually declined during this period from 78 to 74, or about 5.5 per cent. Further examination shows that during this period the aircraft averages attained their peak on November 3, 1939, when this index stood at 48.65. The general market also attained its peak on the same date with the 50 stock average at 93. The air transport high, however, was made on April 12, 1940, with a recording of 34.66. Moreover, the subsequent trend appears to have favored the air transport group over the aircrafts. At the same time, the aircraft manufacturing group appears to have given a better account of itself than the general market.

Not all aviation securities however performed the same as their respective averages. Table I shows the relative movements of representative aviation securities.

What may be another move to clarify the scrambled Aviation Corporation, Aviation and Transportation Corporation setup occurred with the acquisition by Vultee Aircraft, Inc., of certain properties from Aviation Manufacturing Corporation.

The latter company (a 100% owned subsidiary of Aviation Corporation) sold its Stinson Aircraft and Barkley-Grow Aircraft divisions to Vultee. In return Vultee issued a total of 302,168 shares of its stock to Aviation Manufacturing Corp. As a result Aviation Corporation directly and indirectly, increased its ownership of Vultee Aircraft, Inc., from 60 percent to about 75 percent.

It is interesting to note that on June 3, 1940, Barkley Grow was acquired by Aviation Manufacturing Corporation for a total of 42,000 shares of Aviation Corporation stock with an indicated market valuation at that time of about $230,000. The new Stinson Nashville

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TABLE I

Market Action of Aviation Securities One Year After Start of European War

	September 1 1939	August 30 1940	% Change
Air Transport			
American Airlines	28	56	+100
Eastern Air Lines	17	30	+ 87
Pan American Airways	10	14	+ 40
Pennsylvania Central Airlines	8	16	+100
Transcontinental & Western Air	9	18	+100
United Air Lines	10	16	+ 60
BARRON'S Air Transport Average	14.38	26.12	+ 82
Aircraft			
Boeing	21	15	— 29
Consolidated	19	23	+ 21
Curtiss-Wright	5	8	+ 60
Douglas	65	73	+ 11
Lockheed	24	27	+ 13
Martin	22	13	— 41
North American	16	17	+ 6
Sperry	42	39	— 7
United Aircraft	37	40	+ 11
BARRON'S Aircraft Average	36.10	37.15	+ 1
BARRON'S 50 Stock Average	78	74	— 5.5

AVERAGES

	Barron's Aircraft Average	Barron's Air Transport Average	Barron's 50 Stock Average
August 16	41.58	34.04	77
August 23	34.48	25.14	74
August 30	37.15	26.12	74
September 6	39.25	26.97	79

Training Flying Cadets at Civilian Schools

By T. Claude Ryan,
President, Ryan School of Aeronautics

THE Devil could hardly devise a more fiendish torment than is imposed on those of us who live in the heart of "vacation land" and yet can find no time for vacation. But in this period of national emergency we must all do our part. That is why cadets and instructors alike at the Ryan School of Aeronautics turn a deaf ear these days to the call of the bounding waves of the blue Pacific, the sunbathed sands, and the Southern California bathing beauties, and bend with a will to the task of building up Uncle Sam's aerial army just as fast as possible. While the Air Corps cadets who come to San Diego for training at the Ryan School of Aeronautics are kept on the jump to keep up with their schedule, there is some time left over for sight-seeing and most of them will long cherish their memories of this natural playground area.

Unfortunately, or not, depending on the point of view, the Army Air Corps is not maintaining a vacation re-sort at San Diego, any more than at any of the other eight schools now engaged in the primary flight training program. The need of trained pilots is very great and every effort has been made to increase the speed and efficiency of our flight training program, and to expand its scope. Little more than a year ago the plan of conducting primary flight training of Air Corps cadets in civilian flying schools was an untried experiment. Today the experiment is an unqualified success. And once again the American system of utilizing private initiative has been proved successful.

Use of civilian flying schools by the Air Corps has had the great advantage of utilizing the long experience and facilities of the leading commercial schools, and brought about a decentralized training program in a way which would permit rapid expansion, as has now been fully demonstrated. This expansion has been carried on more rapidly than could possibly have been done if executed directly by the Army. In addition the Air Corps has greatly profited by the executive and organizational ability of the various civilian schools.

The launching of the civilian training program is an excellent tribute to the vision, patriotism, and courage of the personnel of the War Department and ranking Air Corps officers who had the decision to make, as the utilization of commercial schools was a drastic departure from anything previously done in this country. To depart from the beaten path always takes courage because if the plan does not prove successful those responsible are seriously

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Instructor Wm. Howe explains rudder operation to a new flying cadet.

Above, Army cadets march out to their training planes at the Ryan school. Below: Rows of Ryan trainers at Lindbergh Field, San Diego, Calif.

Drop Test of Shock Absorber

Testing new equipment is always of great importance. Equally important is the design of test apparatus to make sure that the results are accurate. Bendix Aviation's photographic apparatus should prove of great value.

By W. C. TRAUTMAN, *Chief Designer, Bendix Aviation Ltd*

WE have all laughed when seeing the inimitable Charlie Chaplin forcibly ejected from bar rooms in the motion pictures, but we also winced when Mr. Chaplin's frame made abrupt contact with the pavement. Likewise, we would also wince if we had to watch a modern airliner land without the benefit of our present day highly developed oleo-pneumatic shock absorbers.

Not only does a good shock absorber absorb the energy of "bounce" landings, but it contributes materially to the comfort of passengers by smoothing out flying field irregularities while the plane is taxiing.

The fundamental mathematical precepts of shock absorber design are fairly well established. However they involve the use of hydraulic coefficients which, in the final analysis, are derived from actual drop tests on the shock absorber and wheel combination.

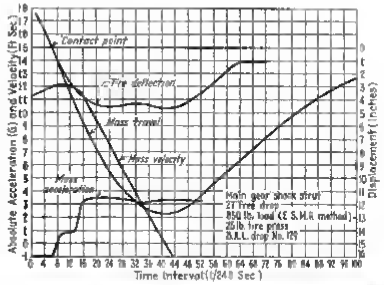
The drop testing of such a combination is not quite as simple as it might appear since it must be remembered that the total elapsed time of a drop test is less than one second. It is quite evident that, in order to record exactly what happened during this one second "oomph" the method of recording must not only be very accurate but also extremely fast. This latter requirement is evidenced when we realize that the maximum acceleration or "load factor" occurs during a period varying from 1/40th to 1/60th of a second.

One of the first methods used for drop test recording was a motor-driven drum on which a pencil, mechanically connected to the shock absorber, traced the path of the shock absorber during the drop. This method, while workable, suffered from lag due to the mechanical linkage involved and the inertia of the recording parts themselves.

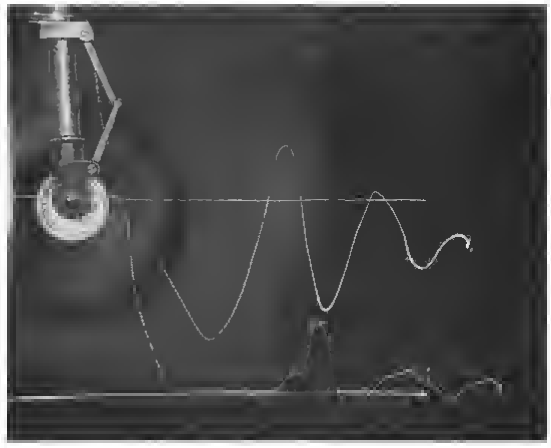
Recently the engineering division of Bendix Aviation, Ltd., has developed a high-speed photographic recorder which has displayed a remarkable degree of accuracy. This equipment is based on the principle of the ultra high-speed camera, but the specific method used is novel, and extremely simple.

Fundamentally the method functions as follows. Light sources of "pin point" nature are provided on the fixed portion of the shock absorber, which is

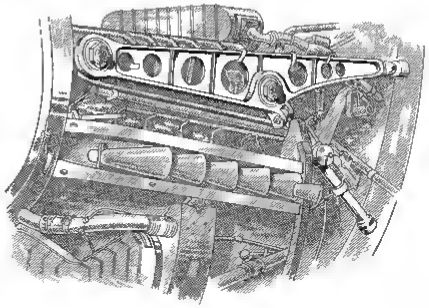
(*Turn to page 94*)



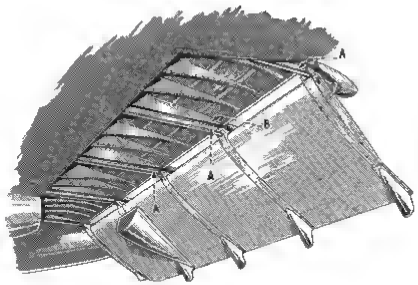
Photograph showing drop test of balloon tire and oleo strut combination. Note extreme bounce. Wheel as shown is about to be dropped and the dashes on the film are caused by the camera shutter



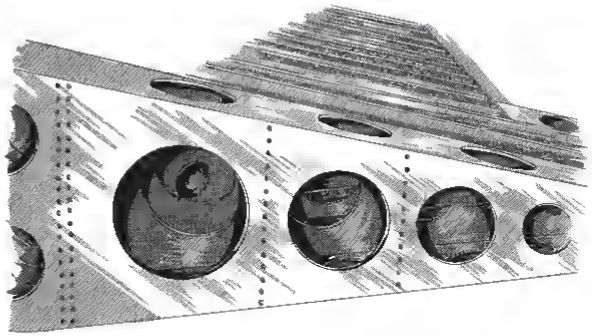
Aviation SKETCH BOOK of Design Detail



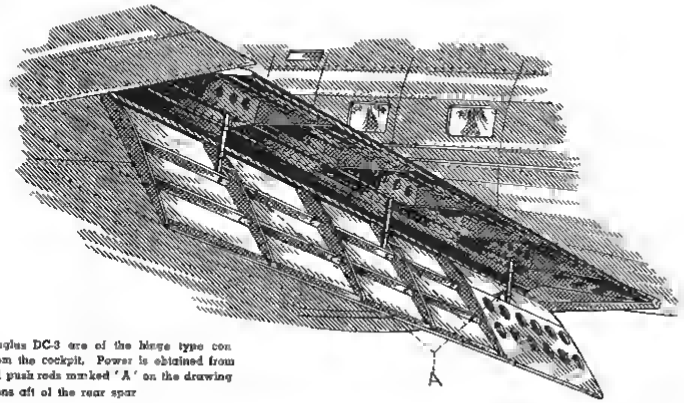
The German Stuka Junkers Ju 87 dive bomber is powered by a Junkers Jumo engine. The engine mount used is of interest as mounts for various places have been standardized. The designs of various mounts all use the same method of engine support and have the main unit forged and support the engine at two points on each side. The points have rubber vibration damping inserts.



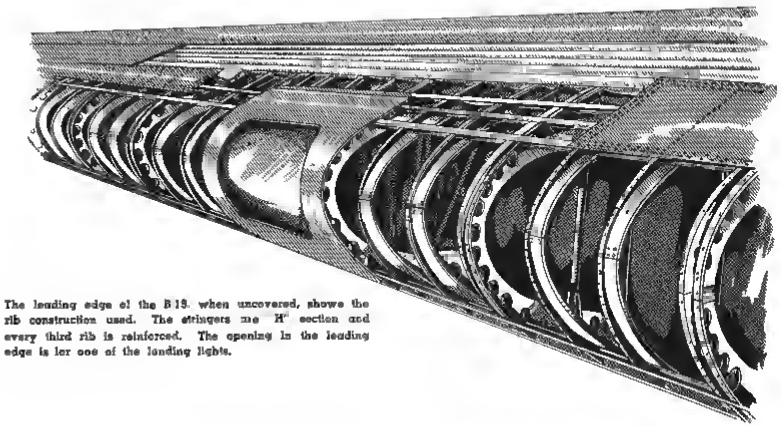
The Fowler flaps used on the Lockheed Transports and Hudson Bombers (left), consist of small auxiliary airfoils located on the under side of the wing near the trailing edge. The flaps travel along the tracks "A" and are actuated by flexible cables "B". The tracks are inclined downward at the trailing edge and when the flaps are at the extended position they are at the correct angle. The flexible cables are driven by a hydraulically operated push-pull tube controlled by the pilot.



A general view showing the rib construction used on the Douglas B-18 216 ft. wing spread bomber. Ribs are of built up Aluminum Alloy



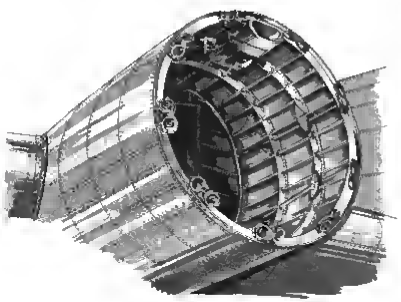
The flaps on the Douglas DC-3 are of the hinge type controlled by the pilot from the cockpit. Power is obtained from hydraulically operated push rods marked 'A' on the drawing The flap hinge line runs aft of the rear spar



The leading edge of the B-18, when uncovered, shows the rib construction used. The stringers are "H" section and every third rib is reinforced. The opening in the leading edge is for one of the landing lights.

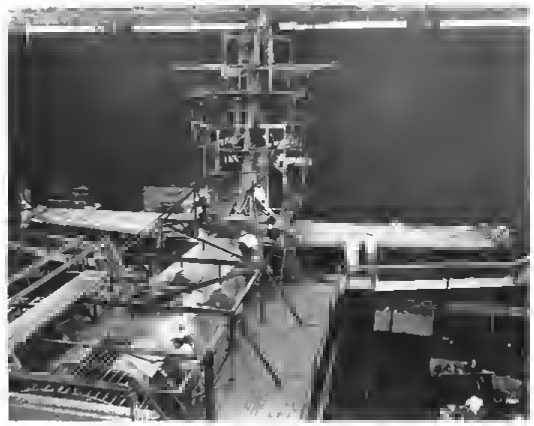
Building the Douglas B-19

The largest airplane ever built is about to be rolled out of the Douglas airplane plant. A bomber with a wing spread of some 210 feet, the plane has been designed for a load of twenty-eight tons and a cruising range of 7,000 miles.



The nacelle skin of the B-19 is Alclad of approximately 040 gauge. The engine mount is of the new Lord "Dynafocal" type with stainless steel tube members running from the shock units to the individual cylinder heads. The cylinder head attachment fitting is a special forging. The shock absorber fittings are three-piece dural castings with one piece for the attachment to the bulkhead and two pieces for clamping around the rubber shock absorbing units. The stiffeners of the nacelle are bulb angle extruded sections except at each shock unit mounting where two "C" sections are used together

to give added strength to carry the engine loads back into the nacelle structure. The nacelle is flush riveted throughout with dural rivets counter-sunk where sections are heavy and counter punched where skin is attached to skin (or thin) section members.



(Upper left) The wing of the Douglas B-19 nearing completion in its steel jig. The tail section is at lower right. (Above) A close-up of the tail section shows the rear gun turret position and the full cantilever construction of the fin and stabilizers.

(Lower left) Hoisting one of the four 2,000 horsepower Wright Duplex-Cyclone engines into place. These engines will swing 16 foot diameter propellers that were recently developed.

Most of the wing was constructed while in a vertical steel jig. The nacelles are large enough for a member of the crew to repair the engines while in flight, with access through the wing

A view inboard from near the left wing tip (Below) shows the wing to be set at a rather high angle of incidence. The main spar of the wing is general is of box beam construction with corrugated aluminum alloy forming the top and bottom. It has a tricycle landing gear.

The control cabin gives some idea of the size of the B-19. Here are ten men working, and all with ample room in the forward part of the cabin, with a space much larger than this below the floor. The wing span of the ship is 210 ft. and it will weigh, fully loaded, more than 140 000 lb. The load capacity is some 56 000 lb. and the airplane is built for range and ornament rather than speed a lesson learned from the war.

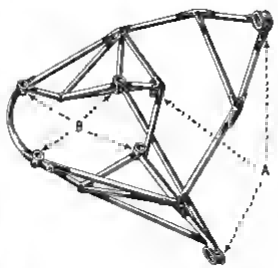
1941 Luscombe

FROM the Luscombe Airplane Corp., West Trenton, N. J., comes a very interesting announcement of a new all-metal trainer for $1,785. The ship is powered by a 65 hp Lycoming engine and is capable of a cruising speed of 102 m.p.h. while landing at 35 m.p.h. With its use intended primarily for training, the interior of the plane has been greatly simplified and possesses only a few of the interior refinements contained in other Luscombe models. Special consideration has been given to make the plane suitable for students and instructors and the seat cushions are removable to allow the use of seat parachutes. With these the seat allows ample room, being 39 in. wide and the eye level is the same as when sitting on the cushions.

The Luscombe has a 35-ft. wing span. Each panel is constructed of two extruded I-beam Dural spars (as are all model Luscombes) on to which are riveted Dural ribs, the cap strips of which are T-shaped extrusions. The nose ribs are simple Dural stampings and the leading edge covering is of thin sheet Dural. Each wing spar has a 3½ ft. sub-spar of lighter Dural at the end and this is of great advantage in the event of wing-tip damage, and has in any number of cases saved the main wing structure. With the use of this, new tip spars may be riveted onto the main spars in but a few minutes in case of replacement. The entire wing is covered with conventional fabric. However, the rest of the airplane is covered with sheet Dural.

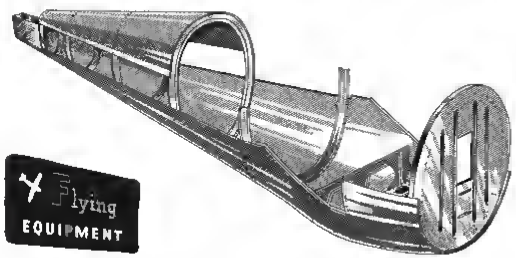
The ailerons, elevators and rudder consist of framework of channel section Dural covered by beaded 17 ST. Alclad. The fin and stabilizer are of the same construction, but covered with smooth 17 ST. Alclad. All control surfaces are

(*Turn to page 106*)

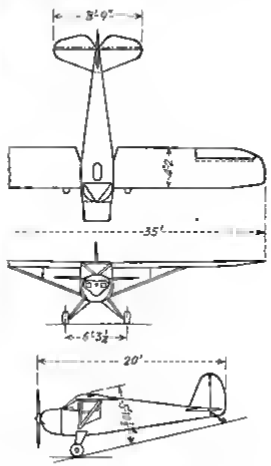


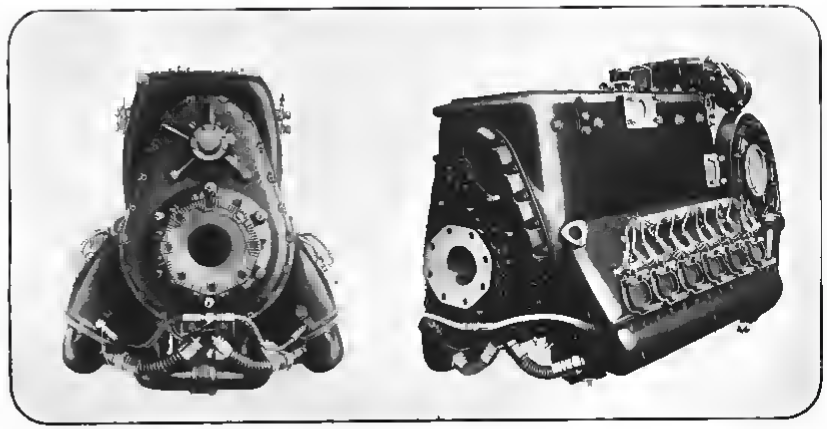
The engine mount is of welded steel tubing and is attached to the stainless steel fire wall at the three points marked A. The engine itself is supported at four points marked B and all of the mountings are to rubber: both at the engine bed and at the three suspension points.

A typical installation of a Lycoming 65 hp engine in a 1941 Luscombe trainer.



The fuselage is a full monocoque structure of .032 in. 17 ST, Alclad skins riveted to stamped Dural oval shaped bulkheads. Previous to assembly the sheets have been drilled in jigs and curved on rolling machines. Bulkheads, set up in one of the main fuselages, are already drilled so that covering skins will fit exactly. The drilled, curved skins, are clipped into place on the bulkheads and riveted on with soft rivets.





Mercedes-Benz Model DB 601

One of Germany's most popular engines is the Mercedes Benz, which powers many of the Heinkel and Messerschmitt combat planes used by the Nazi air force

By Paul H. Wilkinson, *Consultant Diesel Aviation*

THE Mercedes-Benz DB 601 aircraft engine, built by the firm of Daimler-Benz A.G. in its huge factories at Stuttgart-Unterturkheim and elsewhere in Germany, is perhaps the best known military engine in Continental Europe. Undoubtedly, it has seen the most active service as it has been used extensively in large numbers of Heinkel He 111 bombers and Messerschmitt Me 109 fighters since the first days of the European War. It is also used extensively in Dornier Do 1 and Do 215 bombers, and in Heinkel He 112 interceptors and Messerschmitt Me 110 convoy-fighters or destroyers. When production figures are released it would not be surprising to learn that at least 100,000 of these engines were produced during the years 1939 and 1940.

The DB 601 was developed from the DB 600 engine of similar design which was introduced in 1937 to meet the demand for a high-performance military engine. Low weight and economical fuel consumption, together with maximum reliability, were stressed as essential requirements. The over-all dimensions of the engine have been kept as small as possible to reduce head resistance and its exterior cleanness simplifies the cowling problem to a great extent. The inverted cylinder construction and cantilever method of suspension in the airframe permit interchangeability between both models of the Mercedes-Benz engine and the Junkers Jumo 211 engine which is of almost identical size and power output.

The earlier Mercedes-Benz DB 600 was rated at 1,050 hp. at 2,400 r.p.m. for take-off and also developed this power at an altitude of 13,100 ft. It was equipped with a pressure carburetor between the supercharger and the intake manifolds and an automatic timing device which permitted a 10 percent overload for a period of one minute. Using 87 octane gasoline, four of these engines installed in a Junkers Ju 90 airliner established a World's Record by carrying a payload of 10,000 kg. (22,050 lb.) to an altitude of 7,242 m. (23,750 ft.) on June 8, 1938 in Germany.

The latest model DB 601 engine is rated at 1,200 hp. for one minute for takeoff and develops this power at an altitude of 16,400 ft. At 25,000 ft., its power output is approximately 850 hp. It weighs 1,265 lb., or 1.05 lb. per hp. It runs on 87-octane gasoline and is equipped with direct fuel injection whereby its consumption at cruising speed does not exceed 0.45 lb. per hp. per hour. This model has the World's Speed Record of 468.9 m.p.h. to its credit, established in a Messerschmitt Me 109 fighter on April 26, 1939.

(*Turn to page 94*)

Aviation—RADIO

Dialing the Air Waves with Don Fink

Accessory Compass Drive

The Bendix (Baltimore, Md.) MN-31 automatic radio compass, recently announced, is designed for use with the MN-26 direction-finding receiver previously released. The MN-31 is an accessory which includes a power supply and motor control unit and a shielded and enclosed loop with built-in quadrantal error correction and motor drive which operates directly from the visual-indicator circuits of the MN-26 receiver. This receiver produces in its output two 48-c.p.s. voltages which are out of phase by an angle equal to the difference between the loop bearing and the angle of the incoming wave. In the usual visual indicating system these two voltages are applied to the two coils of a dynamometer indicator. In the automatic case one of these voltages is applied to the grids of two gas-filled thyratron control tubes, in two portions, 180 deg. out of phase, whereas the plate voltage of these tubes is supplied, through a triode amplifier, from the other 48 cycle voltage output derived from the receiver modulator. The phase difference between the grid and plate voltages of the thyratrons tubes determines which of these tubes will pass current. The plate circuits of the thyratrons are connected to the motor control circuit through saturating reactors which maintain a 90 deg. phase difference between currents in the two motor windings, so that bi-directional control is possible. The motor rotates the loop until the difference between its bearing and that of the incoming signal is zero whereupon both thyratrons stop firing and the rotation ceases. Overshoot is limited to less than 1 deg. by the use of a dynamic damper which reduces the angular velocity of the loop as the true bearing is approached.

The angular velocity of the loop motion is between 25 and 30 deg. per second, maximum. The bearing accuracy is guaranteed at plus or minus 3 deg. but plus or minus 1 deg. is usually obtained. The loop may always be rotated to the left or right by means of a manually-operated switch, with provision for determining the null position aurally. The bearing is indicated remotely by means of an autosyn electric angle indicator. The quadrantal error system incorporated in the loop indicating system is the same as that previously developed for the manually controlled system. The correction range which may be accommodated is plus or minus 20 deg. The entire equipment including average lengths of cable weighs slightly over 85 lb. The power consumption at maximum input (motor operating at full speed) is 10.8 amp. at 14 volts, or 5.4 amp. at 28 volts.

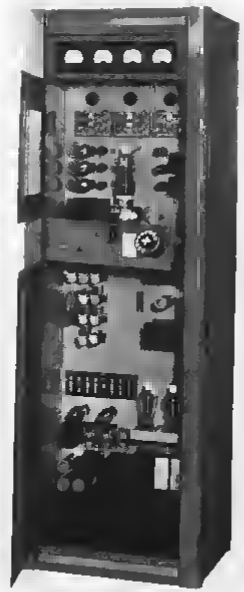
Loop and motor drive of Bendix MN-31 Automatic Compass

50-Watt Ground Station

A dial-tuned radiotelephone transmitter of 50-watts capacity has been put on the market by the Harvey Wells Corp. of Southbridge, Mass. A feature of the design is the use of a single 500-ohm control circuit between the remote control (dialing position) and the transmitter proper. A dial located directly at the transmitter is also provided for local control.

The frequency range is 2,000 to 8,000 kc., within which any three frequencies can be supplied at random. Any type of modulation, phone, cw or mcw may be employed. For audio work the circuits are at within .2 db. from 150 to 3,000 c.p.s., and the distortion is less than 10 percent up to 100 percent modulation. Volume compression is introduced at levels above 70 percent modulation, such that a 10 db. change in input produces a 3 db. change in modulation. Below 70 percent modulation the output is directly proportional to the input. Any unbalanced antenna or transmission line in the range from 60 to 600 ohms impedance may be used, or balanced antennas or lines in the range from 300 to 2,500 ohms.

The three crystal oscillators, one for each frequency, employ Type 42 tubes which drive the final amplifier, a Type RK28A. The speech circuits consist of a 6C5 input stage, a 6F6 modulator, of the suppressor grid variety, and a 6N7 tone generator for mcw. Several local and remote speech amplifier tubes are also used, including a 6H6 diode for in the volume compression circuit. The power input to the transmitter when fully modulated is 750 watts, from a 115 volt, 60 c.p.s. supply. The modulation is controlled, in the case of phone transmission, by a push-to-talk button on the crystal microphone. The line voltage, r-f grid current and plate current of the power amplifier and the r-f output current are indicated on separate meters.

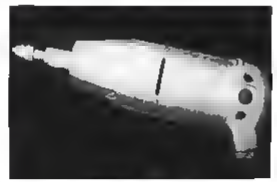


Harvey Wells ground station transmitter

BUYER'S LOG BOOK

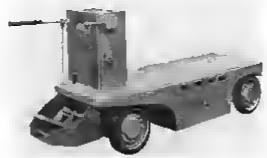
What's New in Accessories, Materials, Supplies, and Equipment

Strangely enough, as we swing to machine production of aircraft, the application of more and better power hand tools becomes a vital proposition. This is because such hand tools are essential to the rapid manufacture of the dies, molds, patterns and other such accessories of machine methods. A necessary partner of the familiar power drill, grinder, buffer, etc, is the power tool supplying reciprocating motion for filing, sawing, chipping, polishing and other operations requiring an action similar to that of the human hand but more powerful and more nearly tireless. Such a tool is the Series "C" Multi-Purpose electric hand tool offered by H & H Research Co., Detroit, Mich. Said to be three times as powerful as previous such tools, the H & H product is but 2¾ in. in diameter, ten in. long and is powered with a 1/30 h.p. 110-volt motor. With a stroke length of ⅜ in. the machine develops a 30 to 40 lb. push or pull at the chuck.—AVIATION, *October, 1940*



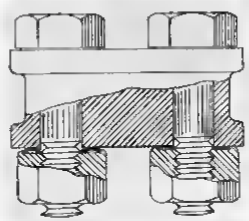
Electric hand tool

Designed to carry all kinds of miscellaneous items, a small electric truck Model KM-28, with a capacity of 3,000 lbs., has been introduced by Yale & Towne Mfg. Co., Philadelphia, Penna. Such a unit should prove of wide application to materials handling problems in some of our recently enlarged aircraft factories.—AVIATION, *October, 1940*.



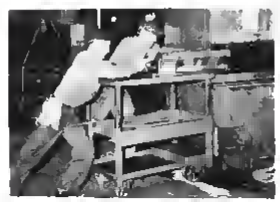
Yale lightweight load carrier

Newest thing in lock nuts is a one-piece device introduced by the An-cor-lox Division of Laminated Shim Company, Inc., Glenbrook, Conn. Utilizing a new principle which provides positive locking of the nut to the bolt, rather than the nut, the An-cor-lox nut incorporates an accurate shaped metal locking ring in the bottom of the nut which is automatically expanded into the root of the bolt thread and against the nut rim as the nut is drawn tight. No special bolt is required and the nut is said to hold securely under all conditions of heat and vibration. The device can be used repeatedly without loss of effectiveness and without damage to the bolt, it is claimed. The new nut is available in all standard sizes and metals.—AVIATION, *October, 1940*.



An-cor-lox lock nut

A handy device around most any factory is the portable Liftable offered by The Service Caster & Truck Company, Albion, Mich. This device is a portable table of electric-welded steel construction with a top measuring 26 in. wide by 43 in. long. A lifting mechanism operated by a hand crank permits varying the height of the table top by 14 in. The table is fully rigid in any position and may be used for heavy work up to 2000 lbs.—AVIATION, *October, 1940*



Service mechanical liftable

To prevent damaging spark plug insulation elements during installation or removal, the Snap-On Tools Corporation, Kenosha, Wisc., has developed a spark plug socket wrench with a neoprene insert in the socket.—AVIATION, *October, 1940*

A novel tool room device for duplicating layouts of drilled holes with speed and accuracy is provided by the Nielsen transfer punch sets now offered by the Nielsen Tool & Die Co., of Berkley, Michigan. Layout punches are made to transfer drill holes through a drilled section in diameters from ⅛" to ⅜".—AVIATION *October, 1940*.

The Aero Disc offered by Pacific Armotive Corp., Burbank, Calif., looks like one of the handiest gadgets ever to hit an aircraft engine shop. Easy to operate as a dial telephone, it carries all data for spark timing, valve timing, and valve tappet adjustment on all standard American aircraft engines from Aeronca to Wright. Durably constructed and reasonably priced, this Aero Disc is sent on approval to any customer.—AVIATION, *October, 1940*

To solve the problems of eccentric loadings which hamper the action of the conventional cantilever type landing gear strut and shock absorber unit, a 'full floating" type landing gear has been developed by Bendix Aviation, Ltd., Burbank, Calif. The new Bendix strut has two members. One carries all loads, and the other is free to act solely as a shock absorber. The combined gear weighs no more than the usual single-strut cantilever gear. A further advantage of the Bendix "floating" strut is that the wheel is pivoted to the support strut by means of a support arm which "rolls with the punch' when the wheel hits an obstruction. This backward movement of the wheel tends to ease the shock of field irregularities more than the restricted action of the single strut gear permits.—AVIATION, *October, 1940*

Snap-On safe socket

Bendix hydraulic landing gear

Logan Engineering Co. Aridifier

Sand blasting is an important feature of aircraft and aircraft engine manufacture and maintenance, but the value of this operation is considerably hampered by moisture in the air lines gumming up the sand in the sand blast cleaning cabinets. Wright Aeronautical Corporation has solved this problem through installation of a battery of twenty-four Aridifier units made by the Logan Engineering Company of Chicago. The units are mounted in the air line just ahead of the sand blasts to permit maximum condensation of moisture in the lines after the compressed air leaves the air receiver. The Aridifier units contain four ball-bearing rotors arranged vertically one above the other. Two rotate in one direction and two in the opposite direction. The compressed air, to pass through the unit, must turn the rotors. Moisture, oil, dirt and fine scale become impinged on the rotor vanes and the moisture thus collected is thrown by centrifugal force to the inside wall of the housing, washing dirt and scale with it. Collected moisture and contamination flow through an outlet out of the air stream to a trap for disposal.—AVIATION, *October, 1940*

There are quite a number of times in aircraft work where an explosion proof lamp—one that is really explosion proof—would be of help. For example, there are many painting operations that have to be performed inside fuselage or nacelles during overhaul operations, where the operator needs good light. For such work a new lamp developed by Stewart R. Brown Mfg. Co., Inc., New York, N. Y., has developed a 100-watt extension lamp that is approved by the Underwriters laboratories for use by paint, varnish and chemical manufacturers, in paint booths, etc. The lamp has successfully withstood rigorous service tests covering vibration, heat, explosion, hydraulic pressure and durability. It is claimed to have two and one-half times the light capacity of any portable lamp of equal weight ever before listed by the Underwriters.—AVIATION, *October, 1940*

A special line of aircraft metal working machinery has been developed by the Farnham Manufacturing Co., Buffalo, N. Y., and is rapidly being adopted as standard equipment for specialized operations in many aircraft plants. The Farnham line includes a spar milling machine which duplicates twists and tapers from master templates, a skin forming roll machine for forming leading edges, a countersinking miller, a draw bench and stretching bench, a duplicating router and drill, riveters, dimplers, jacks, etc. Two models of leading edge skin rolling machines have been developed. Both are alike except that the small machine is limited to rolling thin guage material not over fifteen feet in length, while the larger machine rolls material up to ⅜ in. thick and twenty feet in length. Both machines are completely motorized.—AVIATION, *October, 1940*

(*Window Shopping Appears on Page 92*)

Left, Explosion proof lamp

Above, Farnham forming rolls

THE Aviation NEWS

BLAINE STUBBLEFIELD, Washington | C. F. McReynolds, Pacific Coast | Jay P. AuWerter, New York | E. R. Lockin, New York | OCTOBER 1940

Navy Starts Work on British-Lease Air Bases
Air Corps Reorganizes Squadrons; Designs Embargoed

Washington (AVIATION BUREAU) — As a special Army-Navy Inspection Board left for Bermuda to examine sites for naval and air bases, officials began a study of what installations will be necessary on the string of islands recently leased from the British and Congress prepared for still another appropriation bill for this and other new national defense programs, including conscription and airport expansion.

Radio and meteorological stations, runways, hangars, gasoline storage, barracks, anti-aircraft defenses and similar ship and aviation facilities must be provided at the bases in Newfoundland, and in the islands of Bermuda, the Bahamas, Jamaica, St. Lucia, Trinidad, Antigua, and in British Guiana. Thus the air forces will have an effective radius of 500 miles from the Panama Canal, making a surprise attack on the Western Hemisphere impossible, in the opinion of experts who anticipate completion of defenses off the Atlantic coast within a year.

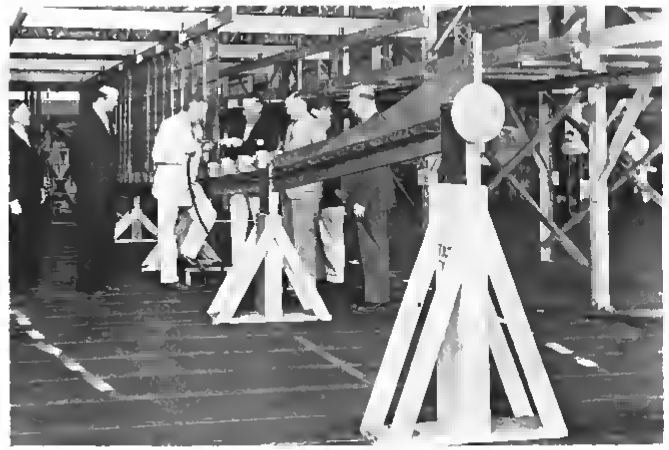
Meanwhile Secretary of the Navy Knox publicly stressed the advisability of acquiring the Galapagos and Cocos Islands in the Pacific although denying that negotiations in this direction had actually begun.

The War Department transferred to Puerto Rico the 24th air base group at Kelly Field and the 25th at Langley, and reorganized the old 24 air base squadrons into a new set-up to increase mobility and operating efficiency. An equal number of new "air base groups" was created, each composed of three smaller squadrons.

Simultaneously Army tests began on the suitability of

(*Turn to page 73*)

ABOVE, RIGHT: a 1,000-foot runway extension at Indianapolis (this one happens to be concrete) is symbolic of one of aviation's greatest needs — new and improved airports. Congress is appropriating $80,000,000 this year to start a program of 4,000 civil fields to cost $560,000,000. Civil airports are important in national defense. The transport plane just taking off is one of TWA's DC3s.



RIGHT: a brief ceremony, first in Naval history to mark the laying of an aerial keel. Glenn L. Martin (in light suit), founder of one of the nation's great aircraft companies, and Capt. De Witt C. Ramsey, of the Navy Bureau of Aeronautics, are driving the first rivet in what will be the world's biggest flying boat. Behind Mr. Martin is Joseph T. Harteen, executive vice president of company.

NATIONAL Aviation

CPT Boys Must Pledge Service to Air Corps
Civil Pilot Training Accident Rate is Low

Washington (AVIATION BUREAU)—At last the civil pilot training program is definitely military. On Sept. 12, Administrator Col. Donald H. Connolly announced that new CPT candidates will be asked to pledge themselves to enter the air service. The pledge is not intended to set the time or circumstance for joining up, but it does bind the pilot to service when called upon. All applicants from now on are required to pass the regular military physical exam.

A notice to the 500 participating institutions authorized recommendation of outstanding male students in preliminary, to the secondary course, which gives a pilot a cumulative total of 200 ground school hours and 60 hours in the air, at the end of which he may be considered for further training. No policy had been formed, at this writing, as to whether CPT students would be excused from the draft, but speculation was that they would be.

CAA's training project has resulted in nine fatalities so far. Two of these were students in primary training, both were stunting in violation of the rules. One secondary student and one instructor in refresher training were killed in a collision. Four instructors have been killed. Two of them were violating the regulations; one in a crash with cause undetermined; one in a collision. Last February one student was killed in a structural failure.

From Nov. 6 last year to completion of the summer session the program will have flown about 1,000,000 hours involving about 34,000 students and instructors. It is stated at CAA that the best record for student instruction in civil flying outside the present control system is 12,000 hours per fatality. CAA's rate figures about 111,000 hours per fatality. Impartial observers here do not attach any blame. They say that a training program of this size could not be expected to make a better record.

Some critics here attacked CAA for not publicizing its pilot fatalities. Others pointed out that local papers had carried the news, that CAA press releases could do no good. The National Aeronautic Association urges that the number of advance students be doubled or tripled to meet the needs of the Army and Navy. NAA also stated that some of the training airports are crowded and that a shortage of suitable planes for advanced training is forming a bottleneck. Incidentally, NAA has an excellent paper on the U. S. pilot situation. At this writing it was not known whether CAA students would escape the draft.

1-2 Billion for Ports

Newest supplemental defense bill provides $80,000,000 to start program of 4000 civil airports including 460 major fields, 1350 medium fields, and 325 small fields. All would have more or less military utility. Total program will cost $560,000,000 over extended period. Help from WPA and to some extent CCC will make $80,000,000 go far. There is no formal deal between CAA and Army on airport expansion and use, but cooperation is close. WPA reports that airport projects outnumber all others on which the Services have requested priority for defense reasons. WPA-built fields must be certified by the Army and Navy. During July and August 73 were so approved.

CONNECTICUT'S Governor Raymond Baldwin breaks ground for Pratt & Whitney's 400,000 sq. ft. addition, while Gen. Mgr. H. M. Horner visualizes these 17,000 Army and Navy engines coming off the line.

School for Inspectors

A standardization center for civil aviation inspectors will be established at Grand Central Airport, St. Petersburg, Florida. Civil Aeronautics Administration has leased the field. Activities will begin this fall. The idea is to meet "growing needs" for uniform nation-wide practice in the various inspection services. It has been found, Administrator Connolly says, that uniformity can be achieved if inspectors are given demonstrations and tests at a place equipped for the purpose. The field at St. Petersburg has good year-round weather; has both land and seaplane facilities; the city is willing to spend some $70,000 meeting special requirements, the lease rate is $1 a year.

Please Don't Crash

Private flying accidents continued as usual, and the Civil Aeronautics Board's reports show that negligence continues as the major cause. One boy dived and zoomed right after his takeoff, turned downwind at 150 feet, and now he's dead. One didn't plan his trip well; landed his seaplane near shore all right but a storm in which he shouldn't have been flying tipped the ship over, and he drowned. Still another made loops at 700 feet, climbed very steep at 1000 feet, the ship stalled, spun four turns before it struck, the pilot is dead. An inexperienced boy went up in a home-made, uncertificated plane, which he skidded at low altitude; it spun to the right, then left, flat; plane demolished; pilot seriously hurt. An instructor with 1000 hours broke vigilance long enough for his student to spin him from 300 feet; plane destroyed; both seriously injured. CAB admonishes you to stay awake and don't crash the crash line.

We'll Be There

The "nation's greatest (winter) air show," Miami's annual All-American Air Maneuvers, Jan. 10, 11, and 12, is going to add an aircraft exhibit this time, plus the Duke and Duchess of Windsor, who said, in re-

SPOT CHECKING

Navy orders for 200 war ships, to make world's biggest fleet, keeps first line of hemisphere defense in surface ships not in the air—yet.

Air Corps is training 2,500 men a year in long-range navigation, in bombing, and in meterology; all enlisted as Cadets, meteorologists to be commissioned in AC, others in AC Reserve.

Mae with brief-cases, by hundreds, are trying to sell all suburban flatlands to US for air ports.

Pilotless airplane, being developed for Army, capable of observing and bombing, sounds incredible but television men say it's in realm of possibility.

Conscription of industry, provided in draft bill, started as consolation for objectors to conscription of men, ended up with real teeth in it. But the National Defense Act of 1916 gives President unlimited power anyway.

Flooding of Packard plant to build Rolls Royce engines is RFC money apparently to be partly refunded by British.

Boeing 6-17-6 cleared for export to Britain, though none ordered yet; some observers think Air Corps will sell those in service.

Negro pilots and mechanics will be trained for service by CAA and Air Corps.

Engine laboratory location is being sought by NACA officials; decision due as you read this, or before.

Three shifts for a number of aircraft plants was ordered by War Department after waiting to get labor training program going.

Sale of 10DC2 transports to the British by Eastern Air is forerunner of further old-model sales of Boeings, Lockheed and others.

Sen. Pat McCarran's resolution for investigation of Penn-Central crash was held up pending Lederer report.

Passenger traffic growing rapidly. Accident had no bad effect. One airline leaving more people on the ground than carrying, for lack of space. Airline equipment design may be frozen to make possible more deliveries.

A New Idea in Airline Communications!

The BENDIX *RTA-1*
TEN FREQUENCY
Aircraft Transmitter-Receiver

CONCEIVED BY THE AIRLINES . . .

Executed by Bendix in Cooperation with

AERONAUTICAL RADIO, INC.

(ARINC SPEC 508-A)

Radically new, the Bendix type RTA-1 communication unit marks a departure from previous aircraft radio systems. It's development is a tribute to customer cooperation. The idea, born in an airline's laboratory, was adopted by member companies of Aeronautical Radio, Inc. Specifications were drawn, and Aeronautical Radio engineers cooperated with Bendix to produce the RTA-1 Aircraft Transmitter-Receiver.

Light, rugged, and compact, the RTA-1 combines 10 crystal-controlled receiver and transmitter channels and integral plug-in power supplies into a single unit occupying less than two cubic feet, and weighing less than seventy-five pounds.

Collective orders for 300 RTA-1 units have been received through Aeronautical Radio, Inc. for the airlines whose routes are shown below. Full information and technical data on the RTA-1 Communication Unit are available on request.

BENDIX RTA-1 UNIT INCLUDES THESE FEATURES:

TRANSMITTER—10 channels, 50 watts 2.5-13 megacycles

RECEIVER—10 channels, crystal-controlled 2-5-13 megacycles

POWER SUPPLIES—Built in

CONTROL—Remote or local

METERING Facilities

WEIGHS less than 75 pounds

SPACE OCCUPIES less than 2 cubic feet

BENDIX RADIO CORPORATION
BALTIMORE, MARYLAND, U.S.A. CABLE ADDRESS: BENRAD

Bendix

STANDARD FOR THE AVIATION INDUSTRY

Dotted lines indicate routes of airlines using other Bendix Transmitters and Receivers. American Export Airlines New York to Lisbon—Mid-Continent Airlines—Northwest Airlines Inc.—Pan American Airlines Seattle to Alaska—Pennsylvania Central Airlines—Trans-Canada Airlines.

Solid lines indicate routes of airlines using Bendix RTA-1 Transmitter-Receiver Units Delta Air Corporation—Eastern Air Lines—National Airlines, Inc.—Transcontinental and Western Air Inc.—United Air Lines Transport Corp.

ply to an invitation, "We will be there." Carl Lambert and Howard Gell, directors, have a 300-ft. tent which will accommodate 150 booths-full of accessories and stuff, while the smartest airplanes will stand outside on the $2,000,000 Master Airport. This glamorous combination is going to pull a big crowd, the boys think, and they've got 22,000 seats on the way. The 1941 show is number 13. It's going to run heavy to "social activity" and you can depend on that. Boy, shake the moth balls out of my tail suit, and oil my aeroplans.

Calling Names

Raymond U. Whitney, an enlisted man in the Army Medical Department won the D.F.C. for subjecting himself to exposure and abnormal pressures in high altitudes during aircraft flight experiments over a two-year period.

300 RAF pilots arrived in Canada to participate in the Dominion's training program.

C. Joe Hunt receives appointment as test pilot for Ryan Aeronautical Co. Was formerly with Williamson Catalin Airlines, and takes over work previously done by Paul Wilcox and Robert Kerlinger, who are now with Ryan School of Aeronautics. Good thing he's not named Bill, because Ryan School already has nine "Bills" as pilot-instructors.

Walter C. Marmon, chairman of board of directors of Marmon-Herrington Co., passed away on August 22.

Roy Hunter and **F. Robert Fossid** are appointed to sales force of Gisholt Machine Co., handling the complete line.

W. L. Beyers is elected president of Noorduyn Aviation to succeed W. R. G. Hall who remains as vice-president. Latter resigned to join Canadian Air Force.

George M. Class is promoted from chief engineer to vice-president engineering of Gisholt Machine Co. Frederick L. Chapman is upped to sales manager, was previously assistant sales manager.

W. P. McGrath, eastern regional manager of TWA, is chairman of an aviation division for the Care of European Children which will solicit funds from the air lines.

Civil Aeronautics Administrator Donald H. Connelly receives appointment to N.A.C.A.

Wilbur Shaw is to manage the aeronautic division of Firestone Tire & Rubber Co. He's the winner of three Indianapolis auto races, is also a pilot.

William Steigerwald and **George Allgire,** Lockheed engineers are in Liverpool instructing English mechanics in the assembling of Lockheed bombers.

Craig Hampton, J. Emmett Penman, and **Roy T. Lah** are made superintendent of maintenance, production manager, and chief chemist respectively of Copperweld Steel Co.'s new plant at Warren, O.

Ralph E. Wirtenberg becomes eastern sales manager of the Detroit Cent. office of New Departure Division of General Motors. F. F. Wesley is made manager of the New York office, Mark Goodchild, chief of the Philadelphia office.

William Rosso goes to Braniff's Chicago office as traffic representative. Tom Moule of Selen, Wolfe & Associates is promoted to vice chairmanship of the 12th annual conference of the National Industrial Advertisers Assn.

Capt. Oliver M. Read, U. S. Navy, has been ordered to duty as Naval Attache and Naval Attache for Air at the American Legation, Ottawa.

F. J. Christy succeeds A. M. Brown as manager of Philadelphia office of Chicago Pneumatic Tool Co. Brown manages new Washington branch. C. A. Diehl is made manager of the Houston office.

Dr. Edmund Rumpler, builder of the "Taube" plane used by the Central Powers in World War I, died in Meckleburg, Germany, on Sept. 10. He was 68.

Paul H. Miles leaves publishing business to become advertising manager of Braniff Airways. Had been in sales promotion end.

B. B. MacCart, chief engineer of Brewster Aeronautical Corp., was elected vice-president in charge of engineering. He developed procedure for designing dive bombers.

THE BRAZILIAN AIR FORCE will get six new North American light attack bombers when this group of officers fly the ships back home. Front row, l. to r. Lieut. H. E. DeFonseca; Major J. S. Maceda, flight leader; Lieut. Manoel Borges Neves. Back row: Lieut. Roberto De Faria Lima; Lieut. Ricardo Nicoli; Capt. Oswaldo Bailaussier, and Lieut. Alaisio Hamerly.

THE WASHINGTON WINDSOCK

by BLAINE STUBBLEFIELD

Defense on Saturday Afternoon

The national emergency is like adventure in the movies, all thrills and no worry. Just try to find the national defenders in Washington on Saturday afternoon.

First time since World War an order for 1,000 airplanes! It went to Republic Aviation for their new pursuit for high altitude attack. The automobile industry passed that milestone in mass production maybe 40 years back.

Airline pension and promotion plans are being streamlined in a number of cases, as operators hurry to outdo Army and Navy in presenting that "wonderful future in aviation" that we have been hearing about for 25 years.

The way things look from here, Air Corps and CAA have really got together on civil pilot training. Col. Donald H. Connelly and Col. G. deFreest Larner, brought into CAA and NAA respectively, are probably behind the newly required pledge from CPT students that they will serve the Air Corps if called.

Friends of Britain, who are in the know, are afraid that Germany, which now has the aircraft plants of France and Czechoslovakia beside her own, can, for a year or more, outbuild the combined plants of Britain, Canada, Australia, and the United States. Nazis have plenty of materials of all kinds.

Do you realize that aviation may not be the last word in transportation? Experts trying to devise pilot pension plans know that other industries saddled themselves with pensioners, decreased in size, and couldn't carry the load. What about compressed air or vacuum tubes, or something, for transportation? they ask. How do you know there will always be airlines? Well, how *do* you?

The Stubblefield award for October goes to Northwest Airlines for the most irrelevant news release of the month. It tells about hot dogs which the line is not serving on its planes.

Forest fire parachuter stories are over-played. Only a few will be used in the West. High-point lookout posts are better. Likewise airplane forest patrol has limited future.

Nazi air blockade of England is not working; ships come and go at will. British officials here can make you believe their loss statements are accurate, while Germans are 80% exaggerated. But U. S. war officials now think Nazi, Czech, and French plane plants combined can possibly outbuild those of Britain, the U. S., Canada and Australia for a year or more.

An expert tells us that New York expects about 2,000,000 scheduled air traffic movements, (takeoffs plus landings) in 1945, that LaGuardia will have to carry the full load, that the field is already saturated. There will be big airport doings next few years.

High octane gasoline will be stored for emergency if the Defense Commission has its way. The Civil Aeronautics Authority suggested storing blending agents only. A standardization agreement is being worked out between all concerned. The fact that the U. S. is so interested in future supply of airplane gas is cited to prove that Germany *must* be having trouble.

Gravelly Point Progress

WASHINGTON (AVIATION BUREAU)—Westinghouse is doing the complete lighting job on Washington's new national airport. Included in the contract are 400 various colored lights for traffic and control, boundary lights, obstruction, range, flood, beacon, ceiling projector, interior fixtures. The whole outfit costs $100,000. Every light can be switched from a single board.

Replacing the conventional wind tee, Westinghouse is working out a new type of wind indicator for Washington; it will be called a smoke pot.

During September the president gave the signal for a group of airline planes, carrying Assistant Secretary of Commerce Robert H. Hinckley and other officials, to land on the new 750-acre Gravelly Point field, whose north-south runway is 5,855 ft. long. Planes of American Airlines, Penn-Central, Eastern Air Lines, the Civil Aeronautics Board, and the Army and Navy participated. This marked the official dedication. Date the airlines would move on was not set at this writing. The field was scheduled for completion about Nov. 1, with final trimmings next spring.

Flying Horse Trade

If you like horse-trading you'll like this. The Civil Aeronautics Board fixes rates on U. S. mail flown to foreign countries. But the Postmaster General fixes rates on mail of foreign countries flown to the U. S. by our own lines—meaning Pan American Airways. Further, it is the PMG's job to collect from foreign countries what they owe PAA for carrying their mail to us. Well, a good many countries in Europe haven't paid, as you might guess. They owed PAA about a million dollars, and PAA wanted it. So Congress passed a law enabling the PMG to pay PAA the million now, and collect it later from Europe. But—Congress took notice that the United States pays PAA about $15,000,000 a year for carrying our own mail, and, if the PMG can't collect from Europe, he can deduct the million from PAA's pay check any time. It's a good trick if you follow it.

A $1,400,000 improvement program is now under way on Lindberg field, San Diego, Calif. Runways are being lengthened, graded and surfaced in preparation for test flights of the four-engined bombers being built by Consolidated Aircraft Corp.

Sperry Gyroscope has leased Curtiss-Wright's Garden City, L. I., plant for use as a research laboratory. All Sperry manufacture will still be in the Brooklyn plant.

Menasco Moves

Menasco Manufacturing Company, Los Angeles, moved into its new Burbank factory during September. The new plant, modern throughout provides 63,500 sq.ft. of floor space. The present factory of 43,000 sq.ft. area will be maintained for operations of the Menasco foundry which is manufacturing alloy castings for the aircraft industry using the Antioch process. A. E. Shelton, Menasco president, has announced sale of 400 new Menasco Modal D-4 engines to Canada for approximately $750,000. This brings total backlog to about $3,500,000.

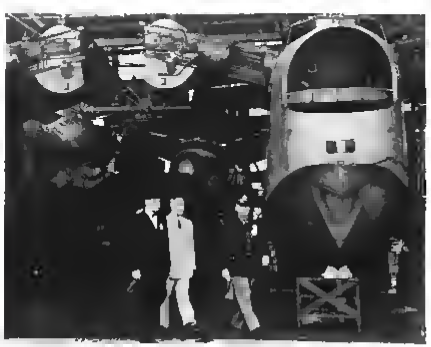
West Coast Airports

Despite the existing need for rapid expansion of airport facilities it appears that many existing airports will not be allowed to continue to exist without a life-and-death struggle. Last year the Dycer Airport in Los Angeles was closed by the city following abatement proceedings initiated by the City Attorney.

Now citizens of Gardena, Calif., are seeking to abate the Gardena Valley Airport as a public nuisance and have petitioned county authorities to take action.

Meanwhile a protracted fight continues over continued operation of Alhambra airport. An abatement suit to stop its operation has been filed in Superior Court by Huber Knight and his wife. The complaint was brought against Western Air College and Airport Management, Inc., operators of field.

Knudsen and Gen. Arnold Inspect the Aircraft Plants



William S. Knudsen production head of the National Defense Commission, and Gen. Arnold, Chief of the Air Corps, take a flying look at the industry. Upper left, they are being shown through the Glenn Martin plant, Mr. Martin between them, huge flying boats in background. Lower left, with Burdette S. Wright at left, they look with pride at the P-40's rolling off the line at Curtiss-Wright plant at Buffalo. Upper right, Robert Gross, president of Lockheed, at left, shows off the new 500 mile per hour P-38. Lower right, at the Farmingdale plant of Republic, left to right; J. L. McClana, v.p. and g.m. of Republic; W. Wallace Kellett, president; Mr. Knudsen; Alexander Kartveli, v.p. and designer; and General Arnold.

Aviation DEFENSE

Aircraft Buying Plan Becomes Definite

Nearly two months after it was first announced that the armed forces had settled on just what planes and engines they wanted to standardize on, the public is beginning to get a glimpse of the program. Only phase definitely announced is the plan for air-cooled big engines: 40,000 are wanted in the next two years about equally divided between Wright and Pratt & Whitney designs. This follows the accepted procedure of having two types of each item needed.

Still largely unsettled is the program for liquid-cooled engines, though it is generally assumed that GM's Allison will take about half the load and Packard's Rolls Royce the other half—with Ford's unofficial and still theoretical liquid engine still an unknown factor. About 6,000 Rolls Royces are believed definitely scheduled.

No authoritative statements have been made on plane types desired, but orders on the early program for which appropriations were completed in June, and first orders under the full program seem to reveal some phases of the pattern.

Definitely part of Army's pursuit squadrons will be Lockheed's P-38E, Curtiss's P-40D, Republic's P-44, and Bell's P-39. Army has apparently resolved its doubts about the radical design of Bell's Airacobra and is buying them in quantity.

As a two-engine ship there is the P-38E. Lockheed's ship is a new two-seater version of the P-38 and is said to be capable of 500 m.p.h.

The P-40 and P-39 are both single-place single-engine jobs using liquid-cooled engines. The P-44 provides an air-cooled engine alternative and is, moreover, especially designed for the high altitudes at which bombers are now operating.

Navy fighter plans are not so well established, but it is clear that a Grumman (probably the Skyrocket) will occupy an important place.

On heavy bombers, Boeing's four-engine B-17E has been bought in largest quantities, but Consolidated's similar B-24D has also been ordered. Medium bombers and attack bombers are still open.

North America's AT-6A is the main reliance for advanced trainers, while Vultee, with its BT-13A, provides most of the basic trainers. Primary trainers, as might be expected, are more split up.

Army and Navy between them want 41,500 air-cooled engines in the 500-2,000 hp. range, and have made arrangements to get them from Wright, Pratt & Whitney, and Ford. P. & W., which is doing all its negotiation with Navy, will furnish 17,000 of the engines. Ford is settling details with the Army on a program to build 4,500 engines on the P. & W. 2,000-hp. design. Wright, which is also dealing with Army, will handle 20,000 Cyclone and Whirlwind engines.

To handle its share, Pratt & Whitney will undertake a 400,000-sq.ft. plant expansion (additional to 700,000 sq.ft. already this year). The company will meet the $15,000,000 cost of buildings, while Navy will pay for and retain title to $7,000,000 or $8,000,000 worth of tools.

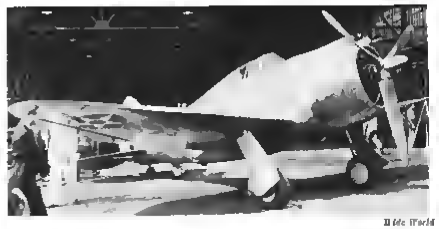
Ford is paying for his own $11,000,000 plant (of which about $7,000,000 is for tools.) He is to pay P. & W. a nominal license fee of a dollar on engine.

The Wright engines involve expansion of more than 1,000,000 sq.ft. and will cost about $30,000,000 to be financed through an RFC defense loan.

Civil Air Reserve

Gil Robb Wilson and Col. G. De Freest Lerner, of the National Aeronautic Association, have been talking with Army and Navy about a civil air reserve and something is likely to come of it.

In case of military operations on this country's borders or within the states, all non-scheduled flying, other than military, might have to be grounded. If the thousands of planes and pilots capable of serving as messengers, transports, observers and relief in disaster could be mobilized, so much the better. An experienced contingent of women fliers also could be organized into the reserve.



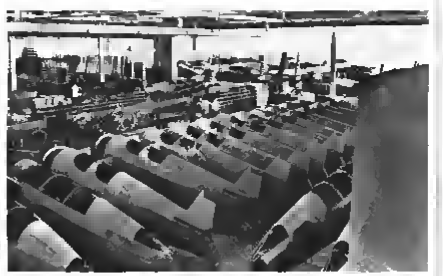
Wide World

GREAT THINGS ARE PROMISED of this new YP-43, made by Republic at Farmingdale, N. Y. How fast it is the Army won't say, but it tops anything ever made by Republic.

Parachute Manufacturers Drap Into Washington

For the first time parachute manufacturers were called to Washington by the Defense Commission to discuss plans for future production. After informal sessions, Commission officials indicated that existing plant capacity appears ample to meet potential requirements.

A special interdepartmental committee was formed, however, to determine more accurately the probable numbers and types of parachutes which will be needed by the Army, Navy, CAA, foreign buyers and private flying schools. Meanwhile, manufacturers agreed to submit detailed data on production facilities and delivery rates.



A NEW SHIP EVERY THREE HOURS is being turned out by Stearman at its Wichita plant. Over 1500 of these trainers have been ordered in the past year. Deliveries are 35% ahead of schedule.

Navy Airbases

(Continued from p. 67)

short-range liaison planes in connection with mechanized units. Six Stinson O-54s are being used in the experiment. The O-54 is a military version of the Stinson 105, powered with a Continental A-80 engine developing 80 b.h.p. at 2,700 r.p.m.

Other national defense developments during the month included a White House proclamation adding to the export control list all plans, specifications and descriptive or technical information of any kind on aircraft and aircraft engine design and construction as well as equipment used in the production of aviation motor fuel and tetraethyl lead, or plans and specifications used in the design, construction or operation of such equipment or in connection with such processes.

The FBI meanwhile offered war industries advice on how to safeguard against sabotage, the Navy asked Congress for authority allowing naval agents to work with civil officers in law enforcement where naval interests are affected.

Aviation ABROAD

British Combine

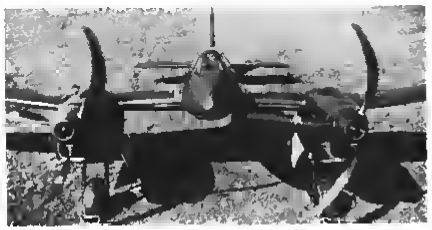
Left: TWO OOZEN 250 FOUNO SOMSS are going into this Wellington bomber before it takes off on its mission to the continent.

Right: RECENT RAIDS OVER LONOON brought the first of these four-engined Junkers 90 transport-bombers. These ships can carry 40 men, or a sizeable load of heavy bombs.

Acme

Below. THE NEW FOCKE WULF Fw 187, twin-engined fighter. It is powered either with DB 601 or Jumo 211 engines. Top speed is said to be about 362 m.p.h. The shutter speed of the camera has caught the propeller tips ahead of the hub.

Keystone



Behnfeld Press

SENIOR OFFICERS OF THE Canadian Air Force and members of the United Kingdom Air Liaison Mission welcomed technical officers of the U. S. Air Corps in Ottawa, where they had flown in an Army Douglas transport. Purpose of the visit was to inspect and fly the Supermarine Spitfire.

Official British Air Ministry Photo

ONE REASON WHY the Lockheed bombers are getting such a fine reputation in England. This ship was severely damaged during the Scandinavian operations, but despite gaping holes in the wings it returned safely to its home base.

Keystone

U. S. Air Corps pilots looking over the Spitfire in Ottawa. The ship is powered with the 1030 hp. Rolls-Royce Merlin engine.

ON SCHEDULE

by "VISTA"

This column is a new feature in "AVIATION"—its purpose is to give the readers an inside look behind the scenes of transport aviation all over the world, its aim, giving constructive news and furthering the use of the airplane as general method of transportation, which, after all, should be the aim of any one connected with this vast industry.

Let's take a look at the remains of European commercial flying this month, but I warn you that the news is not very encouraging. The Swedish ABA is flying a few lines, but is strictly limited in its sphere of operations, according to unofficial news, Germany is fighting to maintain some of its extensive network of lines within "Greater Germany", with a new line to Lisbon from Berlin just opened. The Italians are trying to hang on as well as they can, and so far seem to be succeeding to some extent. England is quietly, but successfully maintaining its far-flung empire routes, including a daily service to Lisbon, flown now with some DC-3's chartered from KLM in London when Holland was invaded, a regular service to New York and of course, Canada, for official passengers, flown with the familiar Short flying boats (Airways Atlantic's Short "C" Class boats were requisitioned for Patrol duty by the RAF).

Holland's commercial airline, KLM, is completely out in Europe, as are the Belgian SABENA, Norway's DNL, and Denmark's DDL, and Switzerland's Swissair, who have nowhere to fly to under the present conditions. Of these, KLM is in the best position, possessing routes all over the world, and is still flying from Palestine to Java and in South America.

As usual little is known about Russia's commercial airlines, but they probably are continuing as usual and as well as they can. Of course, the commercial companies in Austria, Czecho-Slovakia and Poland, listed as the "Oelag", CLS and "LoÇ" respectively, disappeared from the map as the land-grabbing gained momentum in Europe.

It is interesting and instructive also to take a look at the number of American built transport planes which were being used in Europe at the time that the war's labor pains were beginning to be felt. In all, there were some 25 Lockheeds, in use in England, Holland and Poland, while there were well over 60 Douglas DC-2 and DC-3 transports in use by such a varied congregation as Holland, Sweden, Switzerland, Russia, Czecho-Slovakia and Belgium. Of these, about 15 Lockheeds and at least 25 Douglases, most of the latter in Holland, fell into Germany's hands.

In last October's issue a very complete story was given about the KLM workshops located at the Schiphol airport near Amsterdam; it is known now that these shops, once considered the best equipped outside of America, and boasting the most modern American overhauling tools, have been completely destroyed, not so much by the German bombardment during Holland's invasion as by repeated English attacks. The Germans themselves were very careful not to hit anything that might be some use to them, and succeeded 100 percent, and immediately after Holland's occupation most of the ultra-modern equipment was removed, and is now spread over a number of garages in Amsterdam, together with its staff of 400 mechanics.

So it is a sorry sight that meets the eye in Europe, while it is quite sure that many of the lines will never fly again, should the Axis powers gain control of this continent. Should things turn out the way all America wishes, then an enormous and grateful task awaits America's airlines and industries, rebuilding Europe's airlines with American equipment, and perhaps with American personnel.

Aviation PEOPLE

SPEAKING at the official dedication of Consolidated Aircraft's huge new buildings (San Diego, Calif.) on Labor Day, Major Reuben H. Fleet, company president (l.) took occasion to condemn peace-time conscription of plane plants as a deterrent to further expansion. Edgar N. Gott acted as master of ceremonies, and Rear Admiral Charles Blakely (r.) dedicated the plant to preparedness.

NEWLY CREATED SAE Aeronautical Standards Board for National Defense has as chairman Theodore P. Wright. The new board will develop aircraft standardization.

2,000,000 miles of flight over 20 years, without injury to passenger or plane, won for E. Hamilton Lee veteran pilot, the annual merit award of The Assoc. of Men With Wings

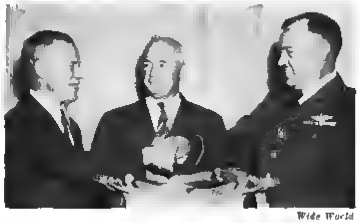
HEADING Chicago School of Aircraft Instruments, new division of Snyder Aircraft Corp. is Dan S. Tilden, former supt. of instrument maintenance for American Airlines.

REMEMBER Richard R. Stoddart, who did such a swell job as radio engineer on Howard Hughes World flight? He's now head of Lear Avia's Pacific division; in radio since 1915

International League of Aviators designated Jacqueline Cochran and Alexander de Seversky world's outstanding flyers for 1939,—the former for five national and two international records and a blind landing, the latter for plane and equipment developments and numerous records. Lt. Col. Robert Olds receives special trophy as commander of the Air Corps South American flights.

WITH WRIGHT AERONAUTICAL CO. since 1927, William W. Finley will manage company's new factory at Lockland, O. Plant will have productive capacity of 1000 monthly.

FRED PAGE has been appointed general superintendent of maintenance for United Air Lines. He had previously been maintenance superintendent of the line's western division.



Wide World

THE MACKAY AWARD, for "the most meritorious flight of the year", was presented to eleven Army Air Corps officers and men. A bomber, piloted by Major Caleb V. Haynes, flew during bad weather to Chile, laden with medical supplies for the victims of the earthquake of February, 1939. L. to r.: Assistant Secretary of War Patterson; General H. H. Arnold, Chief of the Air Corps; Major Haynes.

Leonia Studio

ADEL PRECISION PRODUCTS CORP. has elected Henry S. Tenny a director and plant superintendent. He was founder of American Rola Co., makers of aircraft radio

NEW PRESIDENT of Greenfield Tap & Die Corp. is Howard M. Hubbard, for the last ten years associated with Herrie-Seybold-Potter Co. He succeeds O. G. Millen, chairman

WARNER G. TILSHER, newly appointed factory manager of Taylor-Winfield Corp., has been active in development and manufacture of aircraft fabricated by resistance welding

The Birdmen's Perch

A few months ago we printed a whopper of less than 50 words. This one has several hundred and is about as long as we have room for. Between those two points, lies opportunity ... the chance for any Perch fan to win a specially illustrated Whopper Diploma for the month's extravagantest yarn about Gulf Aviation Gas. Start dreaming up yours ... today.

Major Al Williams, alias "Tattered Wing-Tips," Mgr., Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

NEOLITNIC INSOMNIA-PRODUCER #2

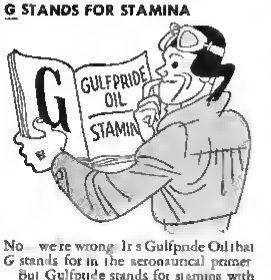
Back in the days when heads first ceased being things to hit with clubs and were initially used to think with, some Stonehenge Euclid whipped up this one

S,END
M,ORE
MO,NEY

If each letter stands for a digit, and the whole business for an addition, what are the numbers?

Send in your answer for correction *with the time it took you to solve, in minutes and seconds.* Remember, the trick is not to do it ... but to do it *fast*

G STANDS FOR STAMINA



No ... we're wrong. It's Gulfpride Oil that G stands for in the aeronautical primer.

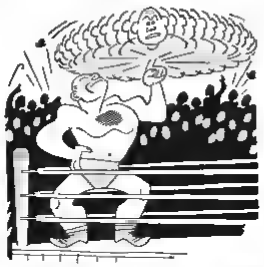
But Gulfpride stands for stamina with hundreds upon hundreds of airline and private pilots. Because they've found out, way up there where it really counts, that the Alchlor process used exclusively in Gulfpride is more than just a scientific rope trick.

It's the honest to gosh means of removing up to 20% more carbon and sludge-formers from Gulfpride's 100% Pennsylvania. *The result?*—the world's finest and longest lasting oil for planes!

THIS MONTH'S WHOPPER

Dear Major:

As manager of Helicopter Hyde, whose wrestling career has recently been cut short as the life of a small neutral nation, I wish to inform you you're being sued. For $769.68. The which is the sum Helicopter expected



to get from his next 18 scheduled fights with Soarin' Sid Ward (also under my management).

You see what Helicopter does—or did—is to travel from town to town where they have boxing shows. Just before the final bout, Helicopter climbs into the ring and offers to fight any man in the audience. Nothing barred but blackjacks over 13½ ounces. Rules. Whereupon Soaring Sid tosses in his checkered cap.

The crowd, thinking it's in— impro— thinking it ain't staged, gets a big bang out of it. Especially when Helicopter whirls Soarin' Sid over his head in a airplane spin letting him fall with a crash you can hear all the way back to the rear of the Ringside section. Then I collects out dough (plus any bets I been able to make while the boys is shucking their clothes). Helicopter helps Soarin' Sid push any misplaced ribs back into place, and off we go to the next town.

We been doin' it for years. Helicopter and me, that is. Every so often somepin' important gets broke in one of the fall boys. Then we got to scare up a new one. Foot walking in a bargain basement or working as a subway guard. We used to try for coal heavers and steel puddlers. They was a more refined type but fragile.

Fact is, we haven't needed any one new for quite a while. You see, this Soarin' Sid is a stayer. So tough he always took his pre-fight massage with regular Gulf gasoline instead of alcohol. Claimed it was the only thing this side of acid that'd make his skin tingle.

Lately he's been complaining that Helicopter's spins have made him so durable (or numb) that even your No Nox gas has no effect. So last night in Left Hand, West Virginia, we stops at the airport and buys Sid a gallon of Gulf Aviation Gas.

Major, it worked fine. Soarin' Sid felt good and that made Helicopter feel good. After the usual challenge they went into the ring like amateurs ... threw each other playfully all over the first six rows. Though I did notice Sid was only throwin' Helicopter with one hand.

Finally, come the airplane spin. Helicopter grabbed Sid, hoisted him overhead and began to twirl. Right there that Gulf Aviation Gas got in its dirty work. Before we know it, those two are whirling so fast that Sid's body acts as a propeller and both of them rise right off the ground ... climb right up to the rafters before Helicopter realizes he ain't standing on nothin'. He looks down, gets scared and lets go. Down he goes.

And, with no one to keep him whirling, down goes The Soarer, right on top of him.

Major it's termific. Sousa's band and a trained seal act couldn't wow an audience like that. They stood on their chairs and cheered for six minutes.

Helicopter will be flat on his back for eight months. What the concrete flont didn't break (they went through the ring). Sid did when he landed on top. So I'm suing.

James W. Spalding

P.S. You don't need to worry none about Soarin' Sid. That G A G made him so tough he's picked up a nice temporary job in a carnival letting folks try to drive spikes in him.

Aviation MANUFACTURING

Army Progressing on 19,000-Plane Program
Military Production 3000 a Month by July, 1942

Here is a tabulation of Army and Navy orders for planes and engines since June 1 to date of going to press. It may be a few squadrons of planes or millions of dollars wrong. There wasn't a summary of orders existing in Washington the day we did this one.

Still waiting on the excess profits tax and plant amortization legislation, the War Department repeated its "letter-of-intent" plan used in connection with the "4247-plane" program—that is to get going on the new program, it fired "speed-up" letters at 21 plane and engine and accessory manufacturers, telling them what approximately is to be ordered, so that they can buy tools and equipment. The letters of intent and the present speed-up letters cover only additional equipment. Actual plant expansion amortization will hinge on law that is pending.

Meanwhile Defense Commissioner Knudsen, on an inspection trip with Air Corps Chief Gen. Arnold, said the defense schedule calls for peak production of 3000 planes per month by July, 1942, and by April of that year a total of 33,000 planes should have been built, of which 14,000 will have gone to Britain. Of the 19,000 for the U. S. 60% will be combat types, and the rest will be cargo, transport, and trainer planes. The present output of engines is 2200 a month. By July, 1941, this figure should be 3500 per month.

Referring again to current orders, the War and Navy deals for 20,000 Wright and 17,000 Pratt & Whitney engines are not orders, but merely agreements, which, no doubt will become orders.

The new Army airplane program under the big appropriation is 14,234 airplanes costing $815,000,000; 26,282 engines, $337,000,000; and propellers and blades costing $27,000,000.

War Department

No.	Type	Contractor	Date	Amount
680	Pursuit Planes	Bell Aircraft Corp.	Sept. 14	$10,600,668
1600	Pursuit Planes	Republic Aviation Corp.	Sept. 14	31,409,934
600	Airplane Engines	Packard Motor Car Co.	Sept. 14	23,446,800
340	Pursuit P-40	Curtiss Wright	Sept. 18	19,658,387
100	Training	Curtiss Wright	Sept. 13	4,221,000
44	Transport Cargo Engines	Curtiss Wright	Sept. 18	12,419,115
	Bomber, heavy, 4-engine	Lycoming	Sept. 18	5,100,007
90	B-24D	Consolidated Aircraft Corporation	Aug. 16	14,801,242
277	B-17E	Boeing Aircraft Co.	Aug. 30	79,440,800
99	Bomber, light or attack, A-20A	Douglas Aircraft Co. Inc.	June 14	
410	Pursuit, 2-engine, P-38E	Lockheed Aircraft	Aug. 30	30,076,797
75	Trainer, Primary PT-13B	Stearman Aircraft Div. Boeing Aircraft Co.	Aug. 16	8,041,947
225	PT-17	Stearman Aircraft Div. Boeing Aircraft Co.	Aug. 16	
100	PT-19A	Fairchild Aircraft Div. Fairchild Engine & Aeronautical Co.	Aug. 16	1,998,300
200	PT-20A	Ryan Aeronautical Co.	Aug. 28	8,076,924
800	Trainer, basic PT-19A	Vultee Aircraft, Inc.	Aug. 28	7,488,782
	Trainer, advanced;			
607	AT-6A	North American Aviation, Inc.	Aug. 14	11,835,631
150	AT-7A	Beech Aircraft Corp.	Aug. 28	4,047,217
20	Transports, C-45A			
67	AT-7	Beech Aircraft Corp.	Aug. 16	3,410,740
83	AT-8	Cessna Aircraft Co.	July 19	900,378
0	Observation, short-range liaison			
105	Rotating wing autogiro, XR-1	Stinson Aircraft Co.	Aug. 24	
1		Platt-LePage Aircraft Corporation	July 10	
130	Pursuit, Airacobra	Bell Aircraft Corp., with garia	Sept. 10	4,008,270
	Engines	Continental Motors Corp.	Aug. 16	1,050,894
	Engines, Model R-1820-05	Wright Aeronautical Corp.	July 8	1,408,278
	Engines	Continental Motors Co.	Sept. 10	1,070,312
	Bombers and spare parts	Glenn L. Martin	Sept. 10	14,280,640
	Training planes	Boeing Aircraft Co.	Sept. 16	6,324,090
	Bomber parts	Boeing Aircraft Co.	Sept. 16	59,702,350
	Pursuit planes parts	Lockheed Aircraft	Sept. 16	16,640,400
	Transport planes parts	Douglas Airplane Co.	Sept. 16	26,830,184
	Training planes parts	Beech Aircraft Corp.	Sept. 17	13,115,138
	Airplane engines	Wright Aeronautical	Sept. 17	6,899,144
5800	Rolls Royce engines	Packard Motor Co.		80,465,000
(6,000 Rolls Royce for British Packard Motor Co. $125,000,000)				

Navy Department

6	Utility-transport	Beech Aircraft Corp.	June 10		$659,261
600	Primary trainers	Naval Aircraft Factory	June 18	No contract	
25	Advanced trainers	North American Aviation	June 11		456,104
600	Primary trainers	Stearman Aircraft Div. Boeing Airplane Company	July 1		3,775,638
201	Primary trainers	Spartan Aircraft Company	July 10		1,853,830
242	Fighting	Grumman Aircraft Eng. Corp.	Aug. 5		7,280,280
10	Utility transport	Grumman Aircraft Eng. Corp.	Aug. 6		
	Patrol-bomber (experiment)	Boeing Airplane Company	June 29		
1	Transport	Lockheed Aircraft Corp.	Aug. 27		217,058
*600	Engines, R-970-4	Continental Motors	July 1		1,442,976
*433	Engines, R-680-6	Lycoming	July 1		1,527,864
*156	Engines, R-760-8	Wright	July 8		602,391

* Engines ordered since July 1, 1940

South American NA-44's

Marking the first aerial delivery of American-made aircraft to Brazil, six North American NA-44 low-wing attack bombers headed south from Los Angeles airport early in September with Brazilian Army officers at their controls. Leading the flight was Major J. S. Macedo. Nineteen steps for refueling and inspection were scheduled for the 10,000 mile delivery trip extending through Mexico, Central America, Colombia, Ecuador, Peru, Chile, Argentina, and Brazil. The Andes were to be crossed near Mendoza, at an altitude of 15,000 ft. The NA-44 attack bombers are powered with 550 h.p. Pratt & Whitney Wasp engines which give them a speed of 215 m.p.h. and range of 1100 miles. According to a statement by J. H. Kindelberger, North American president, the entire order of 30 attack bombers will be delivered to Brazil by such "fly-away" methods.

The six attack bombers built by North American Aviation, Inc., for the government of Brazil, left Los Angeles Airport Sept. 11, as the first contingent of a fly-away delivery of 30 North American bombers for Brazil. Major J. S. Macedo, of the Brazilian air force led the formation, which plans to make the 10,000-mile trip in fifteen days with twenty stops en route. Louis B. Bouchelle, Jr., North American's South American representative, flew one of the planes and the balance were flown by Brazilian army officers.

Increase in Vultee capitalization to permit acquisition of Stinson and Barkley-Grow from Aviation Manufacturing Corp., announced last month, has been approved by Vultee stockholders. Expansion of Stinson's Nashville plant is expected in the near future.

A ROW OF P-40s in the final assembly wing at the Curtiss plant in Buffalo. In addition to its previous orders, the War Dept. signed a contract recently for an additional 540 of these fast fighters. Many are going to England. Fuselages rest on movable dollies. As ship reaches the rear of this line it is set on a wing section, a row of which are seen at left.

Plant Financing

Detailed procedures by which financing of defense plant expansions is to be handled are still unsettled as we go to press. But the money is there and is already being handed out to many manufacturers. One or two things are clear. The government, one way or another, is going to pay within the next five years the cost of armament plant. No manufacturer is going to have to take any risk of losing his own capital if he doesn't want to. But on the other hand there is a good chance that termination of the emergency (if and when) will find the government owning most of the munitions and aircraft capacity in the country.

Major points still in the air are Congressional action on the defense commission's "bankable contract," and allocation of function between Army and Navy's 30 percent advances, the RFC, and the RFC's creation—the Defense Plant Corp.

Meanwhile, if you think you are in the defense business, want money, and don't know where to start, the best thing is to go to the nearest local RFC office. The confusion in Washington won't interfere with your loan.

The bankable contract is simply NDAC's recognition that the government is going to have to pay for plant anyway. Instead, therefore, of doing it through including an amortization item in the price of the armament manufactured, the commission would attach to each defense order a separate contract agreeing to pay the cost of plant in five annual installments. This contract would be assignable and could be used as security for a bank loan. After five years the plant would belong to the government unless the contractor decided to buy it at its then appraised value. This may not be much used or it may turn out to be *the* plan.

Like the bankable contract, the 30 percent advance is useful chiefly to direct government contractors. The advance, in practice, appears to be restricted to such cost-plus contracts as those under which DuPont, Chrysler, and others are building armament factories for the government. The advances are interest-free and involve little red tape.

The subcontractor or manufacturer even farther removed from direct dealings with the government will rely mainly upon RFC or Defense Plant Corp.—it makes little practical difference which. RFC is still working out various types of arrangement. These might vary all the way from a simple 4 per cent mortgage on the new facilities amortizable over five years to a proposal by which Defense Plant would buy machines or buildings and lease them to the manufacturer. If the bankable contract became the accepted way of dealing with prime contractors, the latter scheme might be the preferred financing for subcontractors.

Rearwin Aircraft & Engines, Inc. of Kansas City has been awarded a $150,000 contract for 25 Rearwin "Cloudsters" powered with 120 hp Ken-Royce engines by the Aero Club of Iran (formerly Persia). The figure quoted does not include spare airplane and engine parts augmenting the order, or the several spare complete engines. Most of the ships will be based at Tehran, the capital. The company has been informed that additional units probably will be ordered and a manufacturing license arrangement may be negotiated.

Parts Companies Expand

Expansion of allied aviation parts and supply manufacturers continues to take place in the Los Angeles area. Recent new firms include: Aeroflex Corp., Burbank, established to manufacture flexible hose assemblies to Army and Navy requirements.

Aerco Corp., South Gate, Calif., organized by C. A. Herberts for the manufacture of aircraft parts and power tools. Officers and directors include, C. A. Herberts, pres., E. T. Malone, vice-pres. & gen. mgr., R. A. Livingston, sect'y-treas., and H. L. Harvill, Max B. Harlow, D. N. Macconnel, and W. J. Merrigan, directors.

Pilot Propellers, Los Angeles, organized by W. E. Greenwood, formerly of London, England, with James E. Carol, chief engineer and production manager, for the design and manufacture of aircraft propellers, especially as replacement propellers for private fliers.

Herdman Aircraft Products, Inc., established manufacturer of parts and sub-assemblies, preparing to erect a new factory, has added Lee Crismer and Russell Ragland to the executive staff.

Consolidated Completed

Dedication ceremonies were held September 2nd, for the new Consolidated Aircraft Corp. factory building which virtually doubles the size of the San Diego factory. Completed at a cost of more than $2,000,000, the new building is more than 300 ft. wide and 700 ft. long. With other construction this brings total Consolidated floor space to about 2,000,000 sq.ft., said to be the largest integrated aircraft factory in America. Employment currently totals about 10,000, with 12,000 scheduled to be on the payroll by December, and 18,000 at the peak activity of the present plant.

Aircraft Access. Corp.

Immediate construction by Aircraft Accessories Corp. of a $200,000 plant on an 8-acre factory site in Burbank, Calif., is announced by Ted Lynn, president. Plans call for a modernistic style building of 39,000 sq.ft. floor space, to be ready for occupancy by Jan. 1, 1941. The two plants now being operated by the firm will be discontinued when the new plant is ready.

Recent Awards

War Department

Curtiss-Wright Corp., Buffalo, New York, $97,748 for maintenance parts for planes.
Allison Engine Co., Indianapolis, Ind., $200,055 for maintenance parts for engines.
United Aircraft Corp., East Hartford, Conn., $ 0,022 for propeller assemblies and controls.
Warwick Mills, New York City, $187,700 for airplane cloth.
Wellington Mills, Inc., New York City, $214,132 for airplane cloth.
Suncook Mills, Suncook, N. H., $126,059 for airplane cloth.
Bendix Aviation Corp., Bendix, N. J., $387,845 for regulator assemblies, supercharger.
Bendix Aviation Corp., Bendix, N. J., $73,200 for meters, drift type.
Weston Electrical Instrument Corp., Newark, N. J., $79,440 for indicator assemblies.
Champion Spark Plug Co., Toledo, Ohio, $50,225 for spark plugs.
B. G. Corp., New York City, $335,755 for spark plugs.
Jaeger Watch Co., Inc., New York City, $165,000 for clock and tachometer assemblies.
P. R. Mallory & Co., Inc., Indianapolis, Ind., $56,400 for airplane parts.
Pump Engineering Service Corp., Cleveland, Ohio, $50,353 for parts for pump eng. equipment.
North American Aviation, Inc., Inglewood, Calif., $870,101 for parts for airplanes.
Bendix Aviation Corp., Sidney, N. Y., $132,203 for distributor and magneto assemblies.
Fairchild Aviation Corp., Jamaica, N. Y., $93,900 for computer assemblies.
Glenn L. Martin Co., Baltimore, Md., $798,085 for airplane accessories.
Bell Aircraft Corp., Buffalo, N. Y., $4,862,820 for 120 pursuit airplanes and spare parts.
Lockheed Aircraft Corp., Burbank, Calif., $30,179,787 for pursuit planes with parts.
Boeing Aircraft Co., Seattle, Washington, $70,442,055 for bombing planes with parts.
Ryan Aeronautical Co., San Diego, Calif., $2,074,294 for training planes with parts.
Beech Aircraft Corp., Wichita, Kansas, $4,847,217 for planes with spare parts.
Vultee Aircraft, Inc., Downey, Calif., $7,468,782 for planes with spare parts.
McCauley Steel Propeller Co., Dayton, Ohio, $82,850 for propeller blade assemblies.
United Aircraft Corp., East Hartford, Conn., $149,052 for propeller and control assemblies.
P. R. Mallory & Co., Inc., Indianapolis, Ind., $540,020 for bomb shackle releases.
Square D Company, Elmhurst, N. Y., $109,725 for altimeter assemblies.
Curtiss-Wright Corp., Clifton, N. J., $129,685 for propeller assemblies.
Curtiss-Wright Corp., Buffalo, New York, $10,055,297 for 540 pursuit planes and parts.
Curtiss-Wright Corp., Robertson, Mo., $4,891,700 for 150 training planes and parts.
Curtiss-Wright Corp., Robertson, Mo., $12,410,110 for 40 transport planes and parts.
Aviation Mfg. Corp., Lycoming Div., Williamsport, Penna., $5,190,997 for airplane engines.
Bell Aircraft Corporation, Buffalo, N. Y., $10,955,558 for pursuit planes and parts.
Republic Aviation Corp., Farmingdale, N. Y., $50,499,024 for planes (pursuit) and parts.
Packard Motor Car Co., Detroit, Michigan, $92,448,000 for airplane engines.

Navy Department

Triumph Explosives, Inc., Elkton, Md., $131,856 for aircraft lights float.
Steel Products Eng. Co., Springfield, Ohio, $103,480 for blades and hubs, propeller, aircraft.
Jaeger Watch Co., Inc., New York City, $118,407 for aircraft clocks.
Consolidated Aircraft Corp., San Diego, Calif., $94,112 for airplane parts.
Bendix Aviation Corp., South Bend, Ind., $37,880 for wheel and brake assemblies, aircraft.
Bendix Aviation Corp., Bendix, N. J., $220,000 for aircraft altimeters.
Kollsman Instrument Div. of **Square D Co.**, Elmhurst, N. Y., $401,980 for aircraft altimeters.

THIS NEW BUILDING doubled the capacity of Consolidated Aircraft in San Diego. At left is view of final assembly building, into which two football fields would fit comfortably.

Aviation ENGINEERING

Lockheed Wind Tunnel

In order to speed its program for the development of new aircraft Lockheed is rushing to completion one of the largest and most complete private wind tunnels in the world. Costing $150,000, the Lockheed wind tunnel project is housed in a building 170 ft. long and 70 ft. wide. The tunnel is 400 ft long, of the single return, closed throat type. It measures 20 ft. x 30 ft. at the maximum diameter, narrowing to 8 ft. x 12 ft. at the working section. A 1500 hp. electric motor will drive a six-blade propeller of 20 ft. diameter to develop a maximum tunnel speed of 200 m.p.h. Design of the Lockheed tunnel is unique in that all sections of the tunnel, except the propeller station, are rectangular. In addition to the wind tunnel Lockheed is currently building a total of eighteen new buildings which will provide 520,000 sq.ft. of additional floor space by December. At that time the Lockheed factory space will exceed 1,350,000 sq.ft. and, with the new Vega factory now under construction, will total more than 2,100,000 sq.ft.

NA-35 Rights to Vega

Vega Airplane Co., Lockheed subsidiary, has purchased engineering design and manufacturing rights to the North American NA-35 trainer and is planning a substantial production program for both private and military customers. The NA-35 is a small primary trainer of all-metal construction, two-place tandem cockpits, low wing cantilever, and with a Menasco 125-150 hp. engine for power.

RALPH ELLINGER has been moved up to chief engineer of TWA, following appointment of D. W. Tomlinson as VP Engineering. Ellinger is a 10-year veteran of TWA's engineering department.

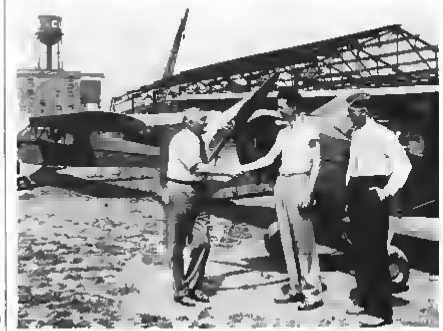
Test Flight Timer

A new device, which is said to ensure absolute accuracy in calibrating airplane speed performance, has been demonstrated at Los Angeles airport to military experts and aviation officials by Louis W. Wait, test pilot for North American Aviation, and Lewis Massie, North American electrical engineer. Operation of the device is based on a combination of photoelectric cells with an amplifying system and accurate timing mechanism. The photoelectric cells, in combination with an optical arrangement of mirrors, are placed in two vertical tubes or "cannons" and interconnected electrically with the timing apparatus in a central recording station. The plane to be tested is flown over the two "cannons," which have previously been accurately located a short distance apart along a well-marked flight path. About ½ mile is said to be ample for the course and approach. The plane must be flown quite low over the course to ensure accuracy, the altitude ranging between 100 and 500 ft. Landing speeds can also be checked easily. This system is said to reduce time and cost of speed calibration.

THE MOULDED SOMS-SAY DOOR held by these two pretty girls from the Glenn L. Martin plant is 14 feet long and weighs but 41 pounds. It is stressed for a load of more than 3,000 pounds and is moulded of plastic bonded plywood.

News From Northrop

The factory that was "forced to expand its facilities before it got into production", Northrop Aircraft Corp., Hawthorne, Calif., is now rushing work on the 24-plane seaplane bomber contract received from Norway last winter. While no official explanation is forthcoming as to the status of the order, it is understood that the planes are being rushed for delivery to England. Powered with an 1,100 hp. Wright-Cyclone engine, the Northrop is a conventional twin-float low-wing all-metal monoplane seaplane with the floats mounted to the wing through cantilever "legs". Performance with full bomb load is set at 228 m.p.h. In order to accommodate this and other orders now going through the factory, a new warehouse and woodshop have been erected and additional equipment installed. The Northrop wind tunnel is nearing completion. With a working throat of 10 ft., the Northrop tunnel will develop an air speed of 150 m.p.h., using a 400 hp. Wright Cyclone engine for power. (See article on page 46 of this issue.)



PIPER hired its 1,000th employee recently. W. T. Piper, left, is shown shaking hands with Clarence Davis, an M.I.T. engineering student. Plant superintendent Hanford Eskman looks on, right.

Industry Aims at New Safety Gnal

Airline Accident Report Due

WASHINGTON (AVIATION BUREAU)—On Ang 31 the nation's worst airline accident ended its longest period of no-fatality flying But the transport industry seemed resolutely on its way toward a new safety goal

There was deep sorraw for the 25 persons lost in the crash and for their relatives and friends, as Penn-Central officers and personnel gathered with Civil Aeronautics Board and nearly a hundred witnesses and hundreds of spartators in the big green and gold Interdepartmental hearing room

But there was no less determination on the port of the operator and the hearing board to find out whet had been the cause They called as witnesses scores of folk from the little Virginia mountain valley where the Douglas struck Members of the company told all they knew without restreint and produced exhibits and records down to the last detail All manner of experts on lightning, turbulence, power plant, propellers, radio, aerodynamics, were questioned All of the information obtained will be compiled in the CAA report due in the near future.

Days of probing the wreckage and the minds of trained people and the strange reports of those who thought they saw and heard things, seemed to avail nothing At this writing the Safety Bureau had still to make its further analysis and report. But most of those who had studied the disaster from the first agreed that only alternative possible causes could be cited, that no sharp conclusion could be drawn.

It was never proved that Trip 19 flew low at Lovettsville other planes were cruising there, and the residents could not demonstrate that they could tell one kind of plane from another No one could show that there had been any structural failure. No evidance of a lightning strike was introduced A theory that the ship was allowed to fly into the ground because the pilots were out of action, presumably stunned by a strike, seemed most plausible. Electrostatic experts said lightning hits planes hundreds of time a year without damage But none would assert that a direct bolt wouldn't cripple plane or men Some airmen thought the craft spun as a result of throttling in turbulence

The cause being unknown only adds to the tragedy for the industry, making their efforts for safety more difficult One thing was clear the accident was not chargeable to the political situation of CAA A coroner's report bit a faint note of irony in finding that the 25 persons had died as a result of an airplane crash.

PAA's Twn Shortcuts

Pan American Airways started two naw important services Sept 1 One was the direct shortcut across the Amazon Valley to Rio de Janairo and the other was a direct run from Miami across the Caribbean Sea to the Canal Zone Both services are operated with Boeing four-motor pressure-cabin planes

The Rio cut-off is only 1,600 miles while the distance around "the hump" between Miami and Rio is 2,600, a saving of 1,000 miles Previous time between the two cities was about five days; naw it is just over 2½ days The new schedule helps to equalize the time between Europe and East Coast South American cities with time from the United States The stratoclippers terminate at Rio, and the West Coast run is continued with DC-3s. Since 1934, PAA engineers have been surveying the over-land cut-off Much of the Amazon Valley which was thaught to be solid jungle, turned out to be open country suitable for flying

The new shortcut across the Caribbean operates three times weekly between Miami and Cristobal, clipping more than 500 miles off the old schedule, and making the run in 6½ hours. DC-3s carry on from the Zone down the West Coast route of Pan American Grace.

Airline Tax Exemption

Exemption for the airlines from the excess profits tax approved by the House, retained by the Senate Finance Committee, seemed likely to pass

Airlines would pay no excess profit tax if after excluding mail payments from gross income for any taxable year after Dec 31, 1939, their adjusted excess profits net income is zero or less.

Although disfavoring exemptions for special industries, committee members decided that it was only practical in the case of the airlines, since their income is governed largely by federal rate-making powers, and made up in part by federal air mail subsidies

Transatlantic Special

Weekly transatlantic service between Ireland and New York via Botwood and Montreal got under way recently, as a subsidiary of British Overseas Airways, which has taken over all Empire lines. It is not believed trips will be on regular schedule, but more on a now-and-then basis, like Italian service to South America. Obviously the line is set up to meet emergency need for communication between England and the United States Overseas Airways operates between England and Lisbon to meet Pan American's transatlantic service, but this is uncertain It has to circle far to sea to avoid Nazi attack, and if Germany should decide to take Spain and Portugal, PAA would have to stop The Britain-New York run carries mail and express and passengers on missions for the Crown

UNITED AIR LINES needs more space at Chicago and its present office building, shown here as the front section, is being doubled in size Rear wing will cost $100,000.

MARCEL E. WAGNER, managing director of American Eastern Co. of Alexandria, Egypt, is opening offices at 630 5th Ave., New York City. Mr. Wagner's organization represents Curtiss-Wright, Bendix, and Fairchild Aviation in the Near East, and now plans to expand its sales activities to Latin America.

Air Freight Debate

Every change of the moon there is a new proposal to carry more cargo by air For reasons known to the transport experts, too lengthy to discuss here, the oft-threatened boom of air express is pushed down as often as it pops up Some day, maybe when least expected, it will rair up and stay up

This time it's freight Persons not mentioned in the public prints propose an air freight carrying system to be operated jointly by the airlines, the railroads, and the Railway Express Twe or three of the Interstate Commerce Commissioners are favorably disposed toward the venture.

Friends of the airlines say the railroads themselves proposed the air freight scheme; that the rail bankers are trying to use aviation as a shot of high-life for their declining earnings Most prevalent opinion is that pilots and suitable equipment for a freight service could not be had at this time

And it Pays to Adv.

"It pays to fly" again will be the catch-word of the Air Transport Association in its second national advertising campaign Full-page advertisements will appear in *Collier's, Life, Newsweek, Business Week, Saturday Evening Post, Time, Nations Business, Sales Management, Editor and Publisher,* and *Traffic World*. Some of the ads will be color spreads, some will be testimonials by business men Heat will be turned on 19,000 travel agencies, which will beve electric flashes, too-Erwin, Wasey & Co is the agent, and Rogers M. Combs is the account man.

Traffic Lights Ahead

It seems inevitable that civil air training, military aviation, and airline operation, all three expanding rapidly, are going to tangle An interdepartmental discussion between the Army, the Navy, and CAB has already forecast measures to solve the growing traffic problem Probably some means will be found to segregate civil and military flying from air transport which is controllable by radio. More airports is the answer now in view. Also, the question of jurisdiction over traffic, as between the federal government out on the lines, and the cities at the air terminals, will come in for some consideration Undoubtedly some changes will be made along these lines A technical committee is studying the question

Air First Aid

Relief Wings, of New York City, organized some weeks ago by Ruth Nichols, is planning to expand and provide relief for victims of disasters and wars at home and abroad. It is already organized for service in the Northeast Hopes to send planes to distribute medicine and food in China and other distressed areas

Airline Doings

Braniff has been granted a certificate to carry mail on its Houston-San Antonio-Corpus Christi flights Eastern Air intervened but was overruled

Trans-Canada has bought six 14-passenger Lockheed Lodestars for delivery Oct. 1. Cost $560,000, and seats are numbered 1 to 15, skipping 13

Chicago & Southern flew 80 percent more passengers first eight months of 1940 than in same period last year About to shift headquarters from St. Louis to Memphis, the line will go southern in its promotion, serving fried chicken and cream gravy aloft.

TWA has ordered 111 1,200-hp. Wright Cyclones, for delivery between September and January, to replace existing 1,100-hp. equipment on all its DC-3s Thirty will go into new ships now on order, and the rest will be for replacement and spares. The change gains 200 lb more payload Engines cost over $1,100,000

TWA is asking CAB for permission to initiate a route from Washington west to St. Louis, with a branch off at Lexington, Ky., north to Cincinnati and Dayton Also asks to include stops at Terre Haute and at South Bend on its New York-Los Angeles and Chicago-Dayton runs respectively

Mayflower Airlines can do a seasonal business carrying resort traffic between Boston and Nantucket and still qualify for an operating certificate, CAB decided.

Canadian Colonial, which has a New York-Montreal certificate, started an intra-state service, New York to Niagara Falls, without asking for a certificate, later put in an application CAB is investigating whether it's legal.

AIR TRANSPORT INDICATOR

September 1, 1940

163.0

Which is the ratio of passenger miles reported by the Air Transport Association for all domestic lines for August, 1940, to the figure for August 1939. Total for the indicator has come back again after its slight set back last month For the first seven months of 1940 traffic stood at 666,076,603 revenue passenger miles—up 67.2 per cent over August 1939.

See Finance page for individual companies' traffic figures

Aviation FINANCE

United Aircraft is spending $15,000,000 to enlarge manufacturing facilities of its engine, propeller and plane divisions at Hartford and Stratford, Conn. This brings to $32,000,000 the total cost of four expansion programs since February, 1936. The company will finance the new plant construction while the Navy buys the tools for the plants at a cost of about $7,000,000 and retains title to them.

Curtiss-Wright is reported to be arranging a $51,000,000 Reconstruction Finance Corporation loan to finance new airplane plants at Buffalo, St. Louis and Columbus, Ohio and to provide new working capital. Such a loan would be in addition to the $92,000,000 RFC loan under negotiation with Wright Aeronautical for a new aircraft engine plant near Cincinnati, Ohio. The new Wright plant may also make engines for tanks. In the past year Curtiss-Wright has expended $20,714,000 for machinery, placed contracts for $7,076,000 in new construction and hired 16,466 additional employees.

Douglas Aircraft is spending $20,000,000 own money for expansion at Santa Monica, a new plant at Long Beach, small plant at El Segundo, total floor space 31,100,000, double present space.

By Raymond Hoadley

Unfilled orders of the aircraft companies have crossed the two-billion-dollar mark and will soar higher as further defense orders pour out of Washington. Some 33,000 war planes—19,000 for Uncle Sam and 14,000 for the British—are scheduled for production by April 1, 1941. To meet this demand aircraft manufacturers have completed expansion plans that will increase the industry's floor space 150 per cent. The added capacity will be financed by RFC loans and company funds. Meanwhile despite excess profits taxes accelerated deliveries will bring 1940 earnings of most aircraft concerns to an all-time peak.

August passenger traffic on domestic air lines established a new peak for the sixth consecutive month while the gain over August, 1939 amounted to about 60 per cent. The 16 air lines reporting to the Air Transport Association are estimated to have flown 110,000,000 revenue passenger miles in August, as compared with 102,358,000 in July and 67,977,000 in August last year. Further gains are anticipated for September with the peak coming in October. In the first eight months of 1940 the air lines flew better than 665,000,000 miles, or only 12,000,000 less than in all of 1939.

Vultee Aircraft, which recently acquired the Stinson and Barkley Grow divisions of Aviation Mfg. Co., plans the immediate construction of additional facilities at both Nashville, Tennessee and Vultee Field, California at a total cost, including equipment, of $6,000,000. President Richard W. Millar states that there is no present intention to undertake any public or RFC financing in connection with the development program as adequate funds are available.

Bendix Aviation has a commitment from the RFC whereby funds up to $16,000,000 will be available for additional plant facilities and is making plans to quadruple its present capacity for aviation parts and equipment. All existing plants will be expanded and at least one, and possibly three, new structures will be built at new locations. The company plans to handle its own working capital requirements through advanced payments on contracts received or through private credits.

North American Aviation may operate the Army's first aircraft factory which will be erected at Dallas, Texas. Under the plan North American would lease and operate the plant on a fixed fee basis. The deal is reported to involve between $7,000,000 and $8,000,000 in new construction.

Current Earnings Reports

Company	Period	Net Income 1940	Net Income 1939	Common Share Earnings 1940	Common Share Earnings 1939
Chgo & Southern	yr. June 30	$20,600	$69,595	$0.06	$0.45
Kinner Motors	yr. June 30	62,939		0.14	
Lockheed	6 mos. June 30	2,022,619	508,360	2.02	0.50
Penna.-Central	6 mos. June 30	122,406	5,333	0.45	
Ryan	6 mos. June 30	87,025	17,204	0.20	0.04
Thompson Products	6 mos. June 30	1,047,902	646,055	3.31	2.13

With the Airlines

Company	Revenue Passenger Miles* August 1940	August 1939	% Gain	8 Months 1940	8 Months 1939	% Gain	Revenue Passengers August 1940	August 1939	% Gain	8 Months 1940	8 Months 1939	% Gain
American	31,254	20,085	55	184,570	123,221	58	90,279	54,122	67	—	—	—
Chicago & Sthn	1,721	825	108	6,784	3,871	75	4,474	2,145	105	25,456	14,084	80
Eastern	11,900	7,432	60	102,864	52,037	58	30,000	20,639	55	216,874	151,411	43
Northwest	6,851	4,608	49	33,851	21,034	60	14,070	9,539	47	81,832	53,254	53
Penn. Central	4,355	2,136	105	24,316	13,201	84	24,698	12,470	98	135,807	75 712	79
T W A	—	—	—	—	—	—	—	—	—	x 153 808	97 625	65
United	25,000	17,217	50	145,427	92,130	58	—	—	—	x 234,084	143 575	63
Western Air	2,036	1,315	55	10,417	6,923	50	—	—	—	x 24,446	15,420	59

* (000-omitted) x 7 months.

Industry Backlog

Unfilled orders of the primary plane producers are now in excess of $2,000,000,000, as against an aggregate backlog of $300,000,000 a year ago. Still larger backlogs are in the offing as the War Department has authorized 21 aircraft companies to tool up for $1,250,000,000 of assured orders. In the case of both Curtiss-Wright Corp. and United Aircraft Corp., unfilled orders are more than twice the $225,000,000 total shipments of all aircraft manufacturers in 1939—a record year. The following table gives the latest approximate unfilled orders of 18 primary companies.

Allison	$40,000,000
Aviation Corp.	15,000,000
Beech	20,000,000
Bell	60,000,000
Boeing	160,000,000
Brewster	45,000,000
Consolidated	125,000,000
Curtiss Wright	550,000,000
Douglas	150,000,000
Fairchild	9,000,000
Crumman	15,000,000
Lockheed	190,000,000
Martin	120,000,000
North American	100,000,000
Republic	65,000,000
Ryan	5,000,000
United	450,000,000
Vultee	80,000,000
	$2,174,000,000

Changes in common stock holdings by officers, directors and principal stockholders of aviation companies in July included the following purchases: 1,750 shares of American Airlines by Ralph S. Damon, 6,000 shares of Eastern Air Lines by Eddie Rickenbacker and 2,000 shares of the same stock by Paul H. Bratten.

Grumman is another plane maker contemplating plant expansion, having purchased a sixty-four acre site for a $1,500,000 factory adjoining its present plant at Bethpage, Long Island.

Republic Aircraft, another Long Island concern, has commenced a $3,000,000 plant expansion that will increase its present facilities at Farmingdale by approximately 500 per cent. The new factory will be in full operation before January and

will permit Republic to utilize the services of 10,000 workers, as against 2,350 in its present space

Vega Airplane is constructing a new factory of 750,000 sqft of floor space on property adjacent to Union Air Terminal at Burbank, Calif. An expenditure of $4,000,000 is involved and occupancy will be taken about January 1, 1941. Major Vega activity just now revolves around a $30,000,000 sub-contract from Lockheed Aircraft Co for bomber-reconnaissance planes. The first semi-annual Vega financial statement, issued by Cortlandt S Gross, president, shows net profits of $12,-687 for the six months ended June 30, last, on gross sales of $737,000

Piper Aircraft is delivering 20 planes a week and, with the new plant in operation, production next year may approximate 5,000 planes, as compared with about 3,000 in 1940. Earnings for the fiscal year ended September 30, 1940 probably were in the neighborhood of $175,000, as against $94,212 in 1939.

Aircraft Accessories Corp., Glendale, Calif., is completing plans for the erection of a new factory to triple present manufacturing facilities. A recent offering of 106,500 shares of Class A common stock was oversubscribed. Steadily increasing orders necessitated further expansion. Present plans call for a building of approximately 30,000 sq.ft. floor space. Employment is expected to increase from 190 employees at present to about 325 by the first of the year. July billings showed an increase of 116 percent over the largest previous month, last May, according to Ted Lynn, president. Net profit for the quarter ending July 31, was $11,261, after all charges.

Offering of 35,000 shares of Solar Aircraft Co. at $7.50 a share, was made in Los Angeles August 19th by Eldred Potter & Co. According to Edmund T. Price, president, proceeds from the sale of stock are to be used for plant expansion, factory equipment, and working capital. A recently announced building program calls for erection of 35,700 additional floor space, to give a total of 111,800 sq.ft., which will permit a 100 percent increase in plant capacity.

Airplane Manufacturing & Supply Corp. is planning establishment of several branches at points on the Atlantic Seaboard and in the Middle West, according to Earl Herring, president and general manager. To finance the expension, and to provide cash for other activities a new issue of 83,226 shares of $1 par value stock has been registered with the SEC. Net income for two months ending May 1, 1940 totaled $16,975 after all charges. Of the authorized capitalization of 500,000 shares of $1 par value common there are now outstanding 279,800 shares.

Here and There . . . *Pennsylvania-Central Airlines* reports a net profit of $43,987 in July, as compared with $13,111 during July 1939. . . . *General Motors* plans to have its new propeller unit in production early next year. . . . *Beech Aircraft* plans a $400,000 construction program designed to double production facilities. . . . *Sperry Corp* payroll has increased from 800 men and women to 4,300 in three years. . . . Net sales of *Air Associates* for fiscal year ended Sept 30, 1940, are estimated at slightly over $3 750,000, as against $1,880,000 the previous year. . . . *Irving Air Chute* is negotiating for U. S. Government orders while its Canadian and English plants are operating at capacity. . . . Allison Engine division of *General Motors* produced 80 aircraft engines in August. . . . *Packard Motors* received a $2,-582,000 Canadian order for Rolls Royce aircraft engines. . . . *Ryan Aeronautical* earned as much in the first half of 1940 as in all 1939. . . . *Aero Supply* has awarded a $30,000 contract for an addition to its plant at Corey, Pa. A recent expansion program has approximataly doubled factory space of *Ryan Aeronautical*, which now totals 180,000 sq.ft. . . . With a backlog exceeding $520,000 *Kinner Motors* is planning a 75,000 sq.ft addition to its present 40,000 sq.ft. Glendale plant. . . . *Boeing's* Stearman division is turning out one training plane every three hours. . . . *American Airlines* may issue a block of preferred stock to finance its 1941 equipment program. . . . *Cessna's* recently completed plant expension has added 60 per cent to the company's floor space. . . . *Waco* schedules the production of three trainers a day in November. . . . *Curtiss-Wright* has tripled plans and propeller production at its Buffalo and Caldwell plants this year. . . . *Consolidated Aircraft* has purchased the Hall Aluminum Aircraft Corporation. Employment at the Pratt & Whitney plants of *United Aircraft* has jumped from 2700 to more than 10,000 in less than two years.

Aviation OPERATORS CORNER

National Sportsmen's Show

The management of the 6th Annual National Sportsmen's Show, to be held in Grand Central Palace, New York, February 18 to 23, 1941, announces that the entire third floor of the Palace will be devoted to the Eastern Light Airplane Exhibition which has just been organized.

The Advisory committee for the exhibition consists of Alfred B. Bennett, Bennett Air Service, Hightstown, N. J., chairman; George Arents, Arents Air Service, Armonk, N. Y.; O. P. Hebert, Safair, Inc., Roosevelt Field, L. I., and Sheldon H. Fairbanks, president of the Sportsmen's Show, with other leading figures in the light airplane field expected to be added.

Believing is what he advertises, Jack West, president of John R. West, Inc., Los Angeles advertising agency specializing in aviation accounts, recently made a flying trip through the East which nicely demonstrates the possibilities of flying for business. West spent six full days in four Eastern cities, using three different airlines, and was back in his office in 30 minutes less than seven days. The trip combined the facilities of Western Air Express, United Air Lines, and TWA. West & Associates have recently added two new aviation accounts to a long list of such firms already added a number of persons to the staff of the home office and moved into substantially larger quarters on Lambert Field, St. Louis. Number of airplane financing contracts handled is setting new records monthly.

A LUSCOMBE AMONG THE LADIES. Scene at Hecht's department store in Washington showing one phase of Luscombe's merchandising methods.

Aviation Credit Corp., St. Louis, has established two new branch offices in the west and southwest to service the rapidly expanding sales of private aircraft, according to announcement of W. R. Shillington, president. Office opened at Ft. Worth, Tex., is in charge of Gene Roger and will serve airplane dealers of Texas and surrounding states. A similar office has been established at Van Nuys, Calif., under direction of Carl F. Baker, to work with California dealers and distributors of aircraft. The Aviation Credit Corp. recently served—Aviation Credit Corp., St. Louis, and Bordeo Manufacturing & Sales Co. of Los Angeles and Dayton, Ohio.

LINCOLN, NEB.—I. V. Packard, secretary of the Nebraska Aeronautics Commission, has announced that about 1,440 airplane pilots will be trained in Nebraska during the coming year, and that $700,000 will be expended on the training. The CAA has allotted three non-college training units to the state, which will be located at Omaha, Alliance, and Beatrice. Advanced training, Packard said, had already progressed so far that it would be necessary to locate two units of ten men each at Hastings, and one at Omaha.

At Beatrice, Jack Gobble, secretary of the Chamber of Commerce, said that Beatrice certainly would have an airport before the opening of the flying school in September. Approval for the school, "now in process of development," was received July 1 from the CAA.

Soaring Contest Results

J. Shelly Charles won top honors and $400 in the American Open Soaring Contest at Lockport, Ill. last month. Other point winners were in this order: Stanley Corcoran, John Robinson, William Putnam, Randall Chapman, Arthur Schultz, Ted Bellak, Helen Montgomery, Don Wise, Edward Laine, George Hall and Laurence Edgar. A total of $2,000 and many additional prizes were awarded these pilots. The Lewis School of Aeronautics and eight other organizations sponsored the meet.

Bill Asheraft, instructor at the Lawrence, Kansas municipal airport, announces that 33 of the CAA flight students enrolled in the Lawrence summer course have been granted private licenses. Two of the ten advanced CAA students have begun cross-country training, the final stage in the advanced course. Pilots in advanced training classes use a Waco PT-14, the type of plane used in army instruction. Another plane will be purchased shortly to speed up training, Mr. Ashcraft said.

Clover Field

In the September, 1940 issue of Aviation, on page 97 of Operators Corner, it was stated that Clover Field, Santa Monica, Calif., had been turned over to Douglas Aircraft Company completely eliminating private flying based at this port. The publisher has received a communication from an operator at this port, to the effect that this statement was not correct. The matter is being investigated and the facts pertaining to this situation will be published in our next issue.

Correction

The article called "Maintenance in the R.A.F." which appeared in our July issue should have carried the by-line of Stuart Masters. It was received directly from the office of the British Air Ministry and due to a misunderstanding, the author's name was not published. Our apologies to Mr. Masters.

Charles Hoffmeist

BETSEY ROSS, left, of Richland, Penna., flew a Taylorcraft to 18,200 feet recently. Russ Brinkley of Harrisburg checks the N.A.A. barograph while A. K. Redmond and John Rogers add their approval. Betsy is 18 and has 226 hours to her credit.

TRAINING

The Chicago School of Aircraft Instruments, a division of the Snyder Aircraft Corporation, will officially open October 1, at Municipal Airport, Chicago. Additional space has been leased in the American Airlines West Hangar, where both theoretical and practical training will be offered high school graduates in the repair, maintenance and installation of aircraft instruments. It is the plan of the school to not only verse the students in instrument technique, but to give attention to other factors entering into employment in the aircraft field—that is, responsibility, personality, and appearance.

The Snyder Aircraft Corporation provides skilled direction for such a course, having had practical experience in instrument maintenance for both private industry and airlines. They are at present authorized sales and service for most of the well-known instrument manufacturers. Ray Snyder is president and active manager.

Dan S Tilden will be at the head of the school.

New Houston School

Aviation Enterprises, Inc. has been organized in Houston, Texas, by R E McKeughan. Primarily a flying school, the organization will also be associate distributor for Piper in that area, and will also represent Erco. Vice president is Henry E Kriegal and L D. McKeughan is treasurer. The school has taken over two large hangars, a shop, a five-room office building and two other buildings formerly used by the Texas National Guard. Houston is now an active aviation center and the new business is looking forward to an active future.

Aeronca Trains Welders

The Aeronautical Corporation of America has been turning out five ships a day and plans to add 50 per cent to its floor space by next spring. When the night shift is completed the company anticipates a production of seven ships per day.

"The problem now is in securing trained factory personnel," said Carl Friedlander, Aeronca President, recently. "In order to do this we have recently opened our own school for welders and machinists in Middletown."

Aviation Institute Expands

The Aviation Institute (a Division of Frank Ambrose, Inc.) an aviation mechanics training school, has just leased a block of property consisting of 52,000 sqft. of floor space and 30,000 sqft of enclosed vacant yard to take care of its rapid expansion. The property is 200 x 240 ft and includes a three-story modern fireproof building, several one-story structures and a paved yard enclosed by a concrete fence. The property fronts on 35th Avenue and occupies the block between 36th and 37th Streets in Long Island City, midway between Times Square and La-Guardia Airport.

The courses cover airplanes, engines, sheet metal, welding, drafting and radio and are of 4 months to 18 months duration. The Aviation Institute is U. S Government approved for airplane and engine mechanics and licensed by New York State.

CHIEF PILOT, TOM OSTERMAIER, of California Flyers School, gives C.A.A. student Margaret Stevenson a parting bit of advice before she takes off in one of the new 220 hp. Waco trainers.

Expansion of the Westwood Correspondence School, Los Angeles, to a full stature as a resident school was celebrated recently with a dinner and reception for executives of the aircraft industry in Southern California. Gordon Brown, president of the school, which will now be known as the Westwood School of Aeronautics, presided at the dinner which was attended by a large number of industrial executives.

Latest specialized aviation training school to be established in the Los Angeles area is the Academy of Aerial Photography, Inc, Los Angeles, with Kenneth A. Smith as founder and president. Extensive research and planning preceded opening of the school, which is offering eleven courses in aerial photography including study of the camera itself, laboratory courses in development of pictures, mapping, engineering, training of photographic pilots, etc. This is believed to be the only school of its kind in the world. In addition to the increasing commercial activities in the field of aerial photography it is believed that the new school will prove a vital unit in the national defense training program. Minimum training course is four months. Classes were scheduled to start on October first.

After three weeks of existence, the National School of Aeronautics in Kansas City, Mo., reports an enrollment of 75 aircraft students, with 105 more scheduled to begin study September 1st. The modern and completely equipped school is directed by airline men who are government rated instructors. At present there are five day-time instructors and the same number for night classes. According to Mr. John Vale, for eight years educational director of TWA, special emphasis is being placed by the school upon training for government A & E licenses.

Boeing School Installs DC-3 Electrical Test Panel

An electrical test panel to familiarize students with problems that they will encounter while servicing airplanes has been constructed and is now in use by students in the Maintenance Elective class at the Boeing School of Aeronautics, under Instructor H. R. Brentlinger.

Testing conditions with the panel are practically the same as if the student were working on an actual airplane. All terminal blocks have been installed, and all conduits are labeled according to the wiring diagram. The wires go through the panel and enter each unit from the back or through conduits. In this way it is possible to trace the circuits by pulling on the wires, and actual tests must be made in order to trace the circuits. Panel lights are employed to represent the various units and to check the operation of the circuits more readily.

A FEW of the 1000 students who are going to school in three shifts at Fletcher Aircraft Schools, at Burbank, Calif.

Recent Books

LET'S FLY—AN A B C OF FLYING, *by Ernest G Vetter* Published by Morrow 116 pages $1.50

Here is an excellent book for flight instructors to recommend to their students It is based on the day to day experiences of an instructor who has an informal way of telling his story Unlike many of the older books on the market, the ship on which instruction is based is a light plane tandem trainer such as is most used today Eric Sloane has done the drawings, which are good.

MACHINE SHOP TRAINING COURSE *By Franklin D Jones* Two vols Vol I, 474 pages, 221 illustrations Vol II, 552 pages, 209 illustrations Published by the Industrial Press, 148 Lafayette St, N Y City Two books, $6, either volume separately, $4

At a time when every aircraft and engine plant in the country is trying to train machinists, either in its own plant or in cooperation with nearby schools, these two volumes fill a need The books form both an elementary and an advanced machine shop course and should prove to be valuable for both shop and school training classes

STANDARD AIRCRAFT WORKERS MANUAL, *Stuart Leavell*, Editor, Fletcher Aircraft Schools, Burbank, Calif 76 pages, looseleaf pocket size, $1 50

A compete handbook of aircraft construction developed over the past five years as a reference manual for men in aircraft manufacturing and instruction work Gives practical, authoritative answers to problems of the aircraft worker Divided into seven sections, it illustrates and describes the uses and characteristics of aircraft materials, tools, drawings, blueprints, mathematics, Army, Navy, and Air Corps specifications, shop, manufacturing, and standard practises, and a glossary of aircraft terms

"AERONAUTICAL DICTIONARY AND REFERENCE LIBRARY", *by Randolph Hartley, Jr*, published by DeVorss & Co, Los Angeles, Calif., $4.00.

This book is more than an aviation dictionary. Into its 524 pages has been condensed the essential factual material of a complete reference library, including specifications of popular aircraft engines, chronological milestones in aviation history, aircraft factory production procedure, a surprisingly complete and up-to-date aircraft industry directory, civil air regulations, and a comprehensive questionnaire for the student. Measuring 5½ by 8 in. the book is limply bound for ease of carrying It should make a good traveling companion

AVIATION—Manufacturing and Transportation, published by *White Weld & Co*, investment bankers, 40 Wall Street, New York, 66 p., 2 maps

In this 148-page book is presented the most comprehensive financial study of the aviation industry published since 1936 One part deals with prospects of the aircraft manufacturers, together with detailed information regarding no less than 5f aircraft and accessory companies Equally interesting is the section reviewing the air trasoport industry and its eighteen principal lines Replete with tables and maps, there is included for good measure a summary of the all-important Civil Aeronautics Act of 1938 This survey spreads before the investor-reader much valuable financial data, thereby placing him in a better position to judge his favorite aviation securities.

FIGHTING PLANES OF THE WORLD, *by Major Bernard A. Law*, with a foreword by Major Al Williams, and color compositions by Barry Bart. Random House, Inc, New York, N Y 66 pages 65 full color illustrations of modern fighting planes. Price $1 00

This timely book is authoritative in both text and illustration, giving up-to-the-minute data on the planes that are engaged in conducting or combatting the current Blitzkrieg So fast does air war move that this volume may serve more as a historical reference work than a handy guide to understanding the daily communiques, by the time this review appears. In any case it will prove a fascinating book.

THE AIR TRANSPORT INDUSTRY, compiled *by J. S. Bache & Co*, New York 48 pages

Believing that it is but a question of time before air transport will rank among the leading American industries, J. S Bache & Co, investment bankers, have issued a handbook on the air travel industry, outlining its principal characteristics and dealing with the individual companies Although giving the financial slant on the business the booklet is non-technical and a ready reference on a fast moving industry Despite the new problems raised by the national defense program, the Bache study concludes that the financial outlook is favorable for the more efficient and better situated air line units

Window Shopping

The following new trade literature may be obtained by writing direct to the firms listed

A new catalogue of aviation uniforms has been issued by the Russell Uniform Company of New York City Illustrated in the catalogue are uniforms for pilots students and hostesses also caps shirts, insignias and identification wristlets as supplied to principal airlines The company having specialized in uniforms for forty-five years states that it is equipped to meet the requirements in for any type of aviation uniform Catalogue mailed on request

The P&H Weld—A regular publication devoted to electric welding. P&H Hunsen WA-200 square frame arc welder—Bulletin W 26—describes this newest arc welder. Harnischfeger Corp., Milwaukee, Wis.

Inconel Engineering Data—A 6 page compilation of Inconel information especially prepared for aircraft engineers, bound and punched for loose-leaf binder The International Nickel Co., Inc. 67 Wall St, New York, N Y.

Micro Switch Data Sheet No. 11—**Data Sheet No. 12**—Describe Type J roller arm actuator attachment and panel mounting and roller leaf micro switches Micro Switch Corp., Freeport, Ill.

Niagara Single Crank Presses—Series 58—Bulletin 63-C—A 26 page catalog liberally illustrated and punched for loose leaf binder describes presses of 2 to 50 ton. Niagara Machine & Tool Works 637-697 Northland Avenue Buffalo N Y

Stow Flexible Shafting—Catalog No. 40—Complete catalog of portable electric power grinders and accessories. Stow Manufacturing Co., Inc., Binghamton, N Y

Weather Magic—A regular publication devoted to air conditioning The Trane Co., La Crosse, Wis.

United States Electrical Tool Co.—**Catalog No. 56**—Covers complete line of electrical tools, including buffers, grinders, drills nut setters, reamer drivers, sanders, saws etc. United States Electrical Tool Co., Cincinnati Ohio.

Washer size finding scale—Sent free upon request, this scale makes possible a speedy comparison of the complete range of washer specifications. Wrought Washer Manufacturing Co., Milwaukee Wis.

Aluminum News Letter—Published monthly to report progress in the application of aluminum to the problems of industry Aluminum Co. of America, Pittsburgh, Pa.

Bearings—A 96 page catalog containing dimensional data on all types of ball bearings tapered roller bearings straight roller bearings and ball bearing pillow blocks. Ahlberg Bearing Co 4727 S Whipple Street, Chicago, Ill.

Engineering Data Sheet—First of a series of technical bulletins to be issued on the physical properties of beryllium alloys, etc. The Beryllium Corp., Reading, Pa.

Bluehawk Wrenches—Catalog No. 240—A 40 page catalog of automotive and aviation wrenches of all types.

Gisholt Standard Tools for Universal Turret Lathes—A 40 page book. Gisholt data sheets Nos. 10 to 45 inclusive. Each sheet discusses the solution of a typical machining problem All shop men will find much practical help in the above listed material. Gisholt Machine Co., Madison, Wis

The new Speedmaster metal spray gun—A new folder describing in detail the latest metal spray gun equipment. Master Metal Spray, Inc., 2527 Magnolia St, Oakland Calif

Designing for Die Casting—A comprehensive 36 page booklet for the engineer employing die cast parts. The New Jersey Zinc Co, 160 Front St., New York, N Y

Niagra Power Squaring Shears—Bulletin 72 A—A 24 page catalog Niagra Machine & Tool Works, 637 697 Northland Ave., Buffalo, N. Y.

Why Anti Friction Bearings—A 112-page text book on the subject. New Departure Division of General Motors Corp., Bristol Conn

Parker Benders, Bulletin No. 40E—A 36 page catalog of tube fabricating equipment. The Parker Appliance Co., 17325 Euclid Ave., Cleveland, Ohio.

Wilson Arc Welding Electrodes—A 24 page catalog Wilson Welder and Metals Co., Inc. 60 East 42d St, New York, N Y.

Drop Test

(Continued from page 55)

mounted in the drop test rig, on the wheel axle, and on two reference points on a fixed standard which is usually placed about 12 in. to one side of the shock absorber. When the shock absorber and wheel combination is dropped in a darkened room the lights on the shock absorber and wheel axle trace light paths which have relative movement, one with the other, and with respect to the two fixed standard lights. These light patterns are photographed as dots by using a motor-driven shutter on the camera to break up the light source. To avoid the congestion on the film caused by having these points fall in a straight vertical line, the camera is mounted on a rigid pivot and "fanned" in a horizontal plane during the time of drop. This produces the exact pattern shown in Fig. 1. Precise "fanning" of the camera is not necessary as the distance or time between the points on the curve on Fig. 1 is equal to the speed of the motor-driven shutter. A shutter speed of one picture every 1/240th of a second has been found to give excellent results as this gives approximately 100 points on the curve, which is ample. The motor-driven shutter on the Bendix recorder is of the rotary disk type, being very similar to the television scanning disks used a few years ago.

Each drop test is recorded on a single photo negative. The completed negative-graph will show four light-dot paths, one for the shock absorber travel, one for the wheel travel, and a horizontal path for each of the two reference lights. The stroke of the shock absorber or wheel can be determined at any time interval by comparison with the two reference lights, which are a known distance apart. To facilitate the computation of the data which results from this graph, the negative is placed in an accurate projector and the image of the graph is projected on a large piece of graph paper, the amount of magnification being adjusted to give an easily scaled distance between reference points. These data are then extended until the curve, showing the load factor developed at any point in the stroke, is found. A representative data sheet is shown in Fig. 2.

Very little similarity exists between the various drop test records encountered, since every combination of shock absorber and tire (and there are many of these) presents an entirely new problem. As an example, the perfect oleo-pneumatic shock absorber would be a strut alone, without a tire. Such units have displayed efficiencies as high as 83 percent. However, this condition is most always modified by the addition of a tire whose volume of air and initial air pressure differ for various applications. In this connection it is interesting to note that the softer the tire used the greater is the rebound of the wheel, and therefore more rebound "snubbing" is required within the shock absorber itself. While low-pressure tires have many distinct advantages, they have increased the problems of the shock absorber designer.

Mercedes-Benz

(Continued from page 61)

With regard to construction details, the crankcase and the two cylinder blocks of the DB 601 are a one-piece casting of Silumin-Gamma alloy with an angle of 60 deg. between the two inverted blocks. The casting is braced by means of five transverse partitions as well as by interior longitudinal and transverse ribs. The steel cylinder barrels are screwed into the cylinder blocks. Each cylinder has two inlet valves and two exhaust valves actuated through the medium of steel fingers by an overhead camshaft along each block. All of the valves have hollow heads and stems and the exhaust valves are sodium-cooled.

The crankshaft is of six-throw design and is machined from a one-piece steel forging with counterbalances. It is supported in seven steel-backed lead-bronze bearings. Each pair of connecting rods functioning on the same throw consists of a plain rod containing a roller bearing in its big end and a forked rod attached to the plain rod by means of plain bearings. The pistons are made of aluminum alloy and are fitted with pins of the floating type.

The supercharger is mounted in a similar manner to the supercharger on the Junkers Jumo 211 engine in that it is gear-driven from a transverse shaft at right angles to the axis of the crankshaft. This arrangement permits full advantage to be taken of the high velocity air stream emanating from the periphery of the closed-type, high-speed impeller. On the DB 600 and DB 601 engines, the supercharger is of one-speed, one-stage construction with screened air intakes in its sides. It is fitted with an automatic boost control and charging pressure governor which maintains a constant pressure in the intake manifolds of the engine until its rated altitude is reached.

Direct fuel injection into the cylinders of the engine is provided by means of a twelve-unit high-pressure pump mounted between the cylinder blocks where it is fed by a Graetzin transfer pump. The high-pressure leads between the pump and the cylinders are of equal length. The ignition system comprises two twelve-cylinder magnetos of Bosch manufacture together with shielded plugs and wiring. The mounting of the magnetos is unusual in that they are attached to a small accessory gear box on top of the rear portion of the crankcase where they and other accessories, such as high-pressure and low-pressure pumps, so mounted can be removed en block for servicing.

The lubrication system functions on the dry sump principle with one pressure feed and two scavenge pumps of the rotary gear type to circulate the oil through the engine and via a small radiator on top of the crankcase, back to the service tank. The used oil collects by gravity in the oil-tight valve covers whence it is removed by the scavenge pumps. The pressure used for the main bearings is 45 lb. per sq. in.

The propeller shaft is hollow to permit firing a shell gun through it and is driven through spur gears having a reduction ratio of 1.55 to 1 or 1.88 to 1. The shell gun is attached to a flange at the rear of the engine with four studs and nuts. The propeller shaft flange is provided with 8 holes and 96 serrations which is standard practice in Germany.

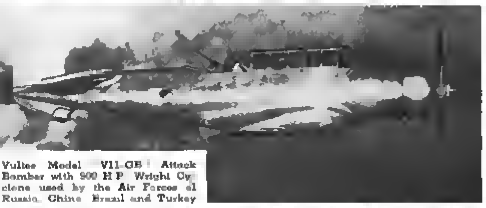
The engine is started by means of a Bosch hand or electric inertia starter flange-mounted on the crankcase where it engages with the rear end of the crankshaft. Water is used for cooling purposes and is circulated by a centrifugal pump in a closed-circuit system. Ethylene glycol is not regarded with favor on account of the servicing complications involved.

Everything of the Mercedes-Benz DB 600 and DB 601 engines has been designed with a view to relieving the strain on the pilot. Apart from the throttle, all of the controls are automatic. The interchangeability which exists between these engines and the Junkers Jumo 211 places the German Luftwaffe in a very strong position for maintaining its war-planes in the field.

Specifications

Mercedes-Benz DB 601 aircraft engine
Type: twelve cylinders, water cooled, 60 deg. inverted vee, geared drive, four cycle
Bore and stroke: 5.90x6.30 in.
Displacement: 2,070 cu. in.
Length and area: 68 in.x6.2 sq.ft.
Rated output: 1,200 hp. at 16,400 ft.
1,200 hp. for take-off
Total weight (dry): 1,265 lb.
Specific weight: 1.05 lb./hp.
Fuel consumption: 0.45 lb./hp./hr.
Oil consumption: 0.018 lb./hp./hr.
Compression ratio: 6.8:1

The Pan American Airways Boeing Yankee Clipper powered with Four Wright 1600 H.P. Engines



Vultee Model V11-GB Attack Bomber with 900 H.P. Wright Cyclone used by the Air Forces of Russia, China, Brazil and Turkey

Seversky Export Fighter with GR1820 G100 Wright Cyclone Engine

Douglas DC-3 Transport operated by T.W.A. and powered with Two Wright 1100 H.P. Engines

Brewster XF2A1 Navy Single Seater Fighter powered with Wright Cyclone 950 H.P. Engine

Douglas DC-3 21 Passenger Transport used by American Air Lines, T.W.A., Pan American and others

Curtiss Scout Bomber equipped with 950 H.P. Wright Cyclone Engine

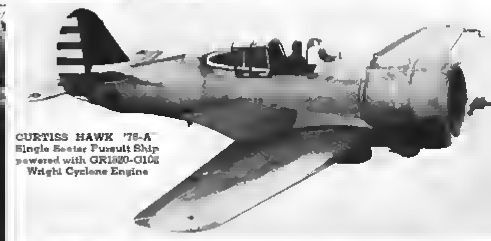
Douglas DC-3 Transport operated by the Royal Dutch Air Lines equipped with Two Wright 1100 H.P. Engines

Curtiss Interceptor with a Climbing Speed of 3000 feet per minute powered with a Wright Cyclone 950 H.P. Engine

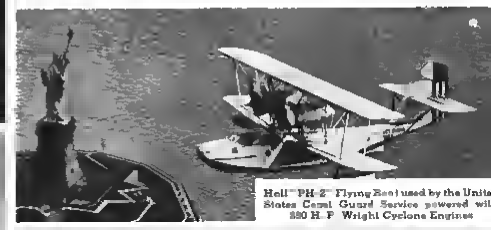
Lockheed Hudson Bomber used by the British Air Ministry equipped with 1100 H.P. Wright Cyclone Engines

Howard Hughes Round-the-World Lockheed 14 powered by Two Wright 1100 H.P. Engines

Douglas XB-19 Army Bomber

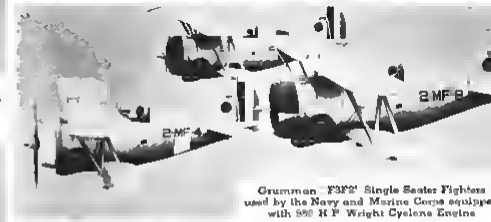


CURTISS HAWK '78-A' Single Seater Pursuit Ship powered with GR1820-G102 Wright Cyclone Engine



Hell "PH-2" Flying Boat used by the United States Coast Guard Service powered with 880 H.P. Wright Cyclone Engines

Consolidated Model '31' with 2000 H.P. Wright Duplex Engines



Grumman "F3F2" Single Seater Fighters used by the Navy and Marine Corps equipped with 950 H.P. Wright Cyclone Engine

Curtiss "SBC 4" powered with GR1820-22 Wright Cyclone Engine

Boeing "307 Stratoliner" used by Pan American and T.W.A. powered with 1100 H.P. Wright Cyclone Engines

Canada

(*Continued from page 31*)

eration of Canada, Great Britain, Australia and New Zealand, under the Canadian government's jurisdiction. (AVIATION, March 1940).

Fleet Aircraft Ltd., Fort Erie, Ont. (opposite Buffalo), and de Havilland Aircraft of Canada Ltd., Toronto, are both turning out elementary training planes, 404 each of the Fleet Finch and de Havilland Tiger Moth, at the rate each of 30 a month during the 1940 summer when mass production first began, and which is being speeded up, as the planes are put into use now that the training scheme is practically in full operation. Engines for both planes come from the United States, though de Havilland's Gipsy engines formerly came from Great Britain and are now replaced by Menasco engines. Fleet is also building a new Canadian designed ship, Fleet 60, for intermediate training. Two hundred of these have been ordered for battle pilot training and production is understood to begin early in 1941.

Noorduyn Aviation, Ltd., Montreal, builds the Noorduyn Norseman, a bush freighter, for the Canadian government for use as troop transport and training plane for radio operators and observers. This company is also building North American Harvard trainers for advanced training, to replace Fairey Battle bombers which Great Britain has been unable to deliver for the training plan. The first Canadian-built Harvard's are to come off the production line before 1940 ends.

National Steel Car Corp. at its Toronto plant is building Westland Lysander reconnaissance planes used also in the training scheme, as well as on active service. Production on this plane is to be one daily by October, 1940.

Fairchild Aircraft, Ltd., at its Montreal plant, is building Bolingbroke bombers, a modification of the British-built Bristol Blenheim bomber.

Canadian Vickers Ltd., at Montreal, is producing twin-engined Supermarine Stranrear flying boats, for active service on Canadian coasts and for training purposes. This is the largest ship being produced in the Dominion.

In addition to these individual aircraft, Fleet, Fairchild, National Steel Car, Canadian Car & Foundry, Vickers, and the Ottawa Car Manufacturing Co. Ltd., Ottawa, are all making parts of the Handley Page Hampden bomber for assembly at the Montreal and Toronto plants of Canadian Associated Aircraft Ltd.

Altogether eight Canadian aircraft companies, according to Munitions and Supply Minister C. D. Howe at a Toronto speech on Sept. 4, have in hand orders totaling 3,800 planes, valued at approximately $125,000,000. He stated 5,000 planes would be needed for the Empire training plan alone.

One of the main type planes used in the British Empire Air Training Plan is the twin engined Avro Anson bomber for intermediate training. The air training plan called for 1,600 of these planes to be supplied as Great Britain's share.

Following the disaster in Flanders, shipment of these planes could not be fulfilled. In fact planes on the high seas enroute to Canada, were sent back from mid-ocean. By late summer Britain was able to send about 300 to Canada again, but meanwhile the Canadian government had gone into the airplane production business and formed Federal Aircraft Ltd., Montreal, to produce 1,500 Avro Anson bombers in Canada. Dynamic industrialist Ralph P. Bell of Halifax heads Federal Aircraft, with R. J. Moffet, formerly chief aeronautical engineer of Canadian Vickers as general manager. Companies producing parts of the Avro Anson for the government owned company are Boeing Aircraft of Canada, Vancouver; MacDonald Aircraft Ltd., Winnipeg; Cockshutt Plow Co. Ltd., Brantford, Ont.; Massey Harris Co. Ltd., Toronto; de Havilland Aircraft of Canada, Toronto; Canadian Vickers Ltd., Montreal; Canadian Car & Foundry Co. Ltd., Amherst, N.S. Four Federal Aircraft assembly plants at Winnipeg, Toronto, Ottawa, and Amherst put the machines together. The Canadian Avro Anson is powered with American Jacobs engines, more than 3,000 of which have been purchased in the United States.

Many Change-over Problems

To change over from British-built to Canadian-built Avro Ansons required a small army of engineers to translate the more than 5,000 blueprints needed to make the plane from British to Canadian-American engineering conventions and to figure costs from British to Canadian and American currency. The entire production of Avro Ansons will be the job of Federal Aircraft with the possibility that other types of planes needed later may also be entrusted to the government corporation. First Canadian-built Avro Ansons are planned to take the air in March, 1941.

Canada is now building most of its own planes, and that it will continue to do so in increasing measure is implied by the Toronto *Financial Post*, leading Canadian financial weekly, in a recent article on Canadian government-owned war companies. Says the paper, "Federal (Aircraft) symbolizes the new and basic defense policy of Canada; do it here, with Canadian machines, technique and supplies as far as possible with help from the United States if essential. That it was a mistake to attempt to build British-type aircraft in this country and to make production here absolutely dependent on Britain is now a conviction that is general in both aviation and government circles."

Aircraft not yet produced in Canada, but which form part of the equipment of the Royal Canadian Air Force include British-built twin-engined Air-speed Oxfords, British-built Short Sunderland four-engined long-range flying boat, British-built Supermarine Spitfire single-seat fighters, British-built Blackburn Shark torpedo bombers, American-built Douglas Digby twin-engined bombers (largest plane in use by the Royal Canadian Air Force), American-built Lockheed Hudson bombers, American-built Boeing transports.

No attempt has as yet been made to produce airplane engines in Canada. It has been under advisement by the government but so far the cost to start such an industry has been felt too great for immediate needs. Thus Canada at present is importing engines largely from the United States, and is understood to share in orders given to the Packard Motor Car Co., for Rolls Royce Merlin 1 050 hp. engines which have so far been coming from Great Britain. Similarly instruments, metal propellers, and certain accessories are also still largely imported. Rubber tires are made in Canada, as the Dominion's time plants have been long established as branches of American and British companies. A machine tool controller to procure machine tools for all war industries, including aircraft, was appointed late in August.

Parachutes are being made for the Royal Canadian Air Force by Irving Air Chute Ltd., Fort Erie, Ont., which has opened a second Canadian plant near Montreal, to facilitate production of war orders.

While Canada had only the nucleus of an aircraft industry's personnel when war broke out, training of all types of mechanics has been pushed by various federal, provincial and municipal governments. Schools for training aircraftsmen for both the industry and the ground forces needed for the air training plan have been opened throughout Canada. Technical schools in all cities have established special aircraft mechanic classes which have operated even during the summer holidays. Provincial governments have voluntarily transferred institutions into aircraft mechanics schools, paying wages to the student mechanics. The federal government, in conjunction with the Royal

(*Turn to page 106*)

Factory Training

(Continued from page 35)

however, that the boys prefer to work as close to home as possible. Brewster is also getting men from the Woodmere High School, to which instructors have been loaned and from a public school in Newark.

These schools operated on a two-shift basis during the summer and are continuing to hold evening classes for adults this winter. As far as possible, applicants for evening training are chosen from among men who have done related work.

J. L. Rice, Brewster's employment manager, has one chief criticism against the men in the national defense courses: they are too young to escape the draft. He feels that up to the present there has been no assurance that men working in aircraft plants would not be drafted. Mr. Rice believes that men over draft age could be found who have assurance of being left in the plants once they are trained.

Active Programs at Wright

At Wright Aeronautical Corporation in Paterson, N. J., training is an old story. An engine factory is actually a large machine shop—and machinists don't grow on trees. It takes longer to train a machinist than it does to train a pilot. In the past Wright has had four different training plans in operation; one for its engineers, one for foremen, one for its machinists, and another for the employees of its customers.

The most active programs today are for the engineers and machinists. About 632 young engineers are now attending basic courses which continue for 10 months. All classes are given during the day time and are combined with actual work. Under the direction of Assistant Personnel Director Walter Bishop a well-rounded curriculum has been worked out and the corporation is convinced that the plan is paying dividends.

The Edison Vocational School of Paterson is one of the chief contributors to the machinists' training plan. This school has an abundance of machine tool equipment and is able to provide training on any of the standard machines. It is now operating on a 24-hour basis, and is giving four weeks courses. The first week of each course is a general introduction, and the remaining time is devoted to working on one machine. Then if the trainee can meet the Wright standards he is employed and continues on the one machine he has been learning. He is put with a skilled machinist for eight or ten weeks. During the first week he does nothing but watch. Then little by little he learns to handle the machine. After his training and breaking-in periods he is put on his own.

As Wright Aeronautical has grown, an increasing number of men have been needed for engine test and engine assembly. A number of men for these departments have come from the private aviation schools. When the company's huge plant in Cincinnati is finished, thousands of men will be needed there. Personnel Director Auser is planning to secure many of his apprentices for this plant from the trade schools in that area.

Pratt & Whitney

At a time when most of the aviation industry wishes it had started its training plans some years ago, Pratt & Whitney Aircraft of Hartford is reaping the benefit of its far-sightedness. Four years ago, under the guidance of Harry C. Smith, it began its apprenticeship classes and now the students from those early classes are holding responsible jobs in the factory. Apprentices are high school graduates who seem to be well qualified. Three years are required for the machinist course, and four years for the toolmaker course. Training is divided between shop work and class work. Men are routed through many different departments, spending a maximum of 12 weeks in each.

Class work, given in the plant during working hours, for which apprentices are paid, is supervised by the Connecticut State Trade School. At the end of the first six months an apprentice may enroll in the apprentice technology course given by the University of Connecticut, which requires six hours of evening work per week, plus additional home study. These classes are also held at the P & W plant with the exception of laboratory work at the University. Three and one-half years are needed to complete this course.

In its rapid expansion, the company could not train apprentices fast enough, and has also been using a learner plan, in which a youngster with mechanical aptitude is placed along side a skilled man and is taught one job by the old-timer. Because of the careful selection, and the cooperation of the plant's machinists, this scheme has worked well.

The entire state of Connecticut has been alive to the need for mechanical training for some time, and its trade schools have been operating on an around-the-clock basis. Public schools which could take only high school students in the day sessions have been opened all night to qualified students. Such schools have operated in Hartford, Manchester, New Britain and Bridgeport. Pratt & Whitney has supplied teachers to two of these schools.

P & W has training for its young engineers, and also has four hours of instruction per week in blueprint reading and shop mathematics for any employees who want to enroll. That "training pays" is now a firm conviction at Pratt & Whitney.

Training at Martin

At Baltimore the Glenn L. Martin plant has had a carefully work out training plan for ten years. Expansion has been steady in the past few years and Martin has already met a number of training problems which other plants will be facing this year.

Under the general direction of Daniel W. Siemon personnel director, a variety of training programs are now being carried on. Mr. Siemon has worked out a close cooperative system with public schools in his area which is especially noteworthy. The Baltimore vocational schools have a two-year course in aircraft sheetmetal work, and a two year course for welders and fitting makers. Other courses train men for machine shop and pattern shop work.

At the Baltimore Polytechnic Institute Saturday morning classes are given in blueprint reading and shop mathematics. Martin engineers serve as instructors. Many of Martin's own employees took the course. Last year about 1,400 students took the course.

At Kenwood High School a night school was opened for seniors and for Martin employees. Company men again served as instructors. Three courses are given: blueprint reading, shop mathematics and business English. Tools and equipment were furnished for adult vocational courses operated by the City, and the Company has also worked closely with numerous, trade high schools and given advice concerning their courses. Martin has even employed a number of teachers in the plant during summer months so that they might become familiar with plant operation. Cooperation is given to colleges and engineering schools in the Baltimore area, and schools as far away as Hershey, Penna., have been given helpful advice on aviation courses.

To train its young engineers, the Glenn L. Martin Engineering School is now being operated in a down-town office building. More than 100 engineers attend this school full time, for which they are receiving pay. Classes dovetail closely with the practical shop training which Martin engineers get in the factory. All in all, Martin is doing a highly commendable training job.

Under the skilful direction of Charles S. Mattoon, Personnel Manager of the Curtiss Aeroplane Division at Buffalo, factory training methods have been carried on there for several years. One of the reasons that P-40s are rolling out

(Turn to page 126)

THE 101ST FAIRCHILD TRAINER GOES INTO ACTIVE SERVICE

Although the Fairchild M-62 Trainer is a completely up-to-date trainer in design and construction, there is behind it today an impressive record of performance and hours in the air, *proving in practice* the worth of this exceptionally rugged and thoroughly modern airplane. More than one hundred Fairchild Trainers have already been delivered to the U. S. Army Air Corps for use in training Air Corps cadets, as well as to commercial schools in the advanced CPTP program. And twelve more M-62's leave the factory every week to engage in the serious business of developing competent pilots for America in the shortest possible space of time!

(SPARTAN SCHOOL LITHOGRAPH)

FAIRCHILD AIRCRAFT

Division of Fairchild Engine & Airplane Corporation
Hagerstown, Maryland Cable Address "Faircraft"

PRECISION IS AS IMPORTANT IN VALVES AS IN INSTRUMENTS

Instruments and equipment of finer precision and improved design have brought about blind flying, high altitude flying and scores of other developments . . . HALL Valve Servicing Equipment brings similar precision and improved methods to the grinding of valves and valve seats and permits blind grinding to a precision and finish that insures greater power and improved performance . . . even at high altitudes . . . Adopted for production or service by army and navy air bases of various governments, transport companies and engine builders, HALL ECCENTRIC Valve Seat Grinders and Wet type 2-speed Valve Refacers insure full contact valve seating in far less time with finest precision and finish and at less cost . . . No need for hand lapping the toughest seats . . . Write today for completely descriptive catalog or put your valve problem up to HALL engineers.

THE HALL MANUFACTURING COMPANY
1634 Woodland Ave. Toledo, Ohio

HALL Model AW Wet Type ECCENTRIC Valve Seat Grinder with Ammeter. Can handle seats in small 4" dia. cylinders and valve stem guides ¼" and up

HALL Wet type, 2-speed Valve Refacer with Micrometer Feed and Collet that overcomes brinelling of valve stems.

HALL Model EJA ECCENTRIC Valve Seat Grinder widely used for slight angle valve seats and all in-line motors.

HALL
ECCENTRIC
VALVE SEAT GRINDERS

Where Are Those Profits

(Continued from page 33)

Shock and Landing Gear Springs
Upholstery Tacks
Flat Wire
Steel Bar, Rod & Strip
Fiber Products
Brass Products
Paints
Clamps
Switches
Fuel & Oil Gaskets
Copper
Aluminum Bar

Illinois received 2% of this total for furnishing the following finished and raw materials:

Paint
Pyralin
Plywood
First Aid Kits
Felt Products
Accessory Controls
Turnbuckles
Grommets
Brass Safety Wire
Clevis Pins
Bolts, Nuts & Washers
Piano Wire
Electrical Wire
Upholstering
Fuses and Holders
Rheostats
Sound Insulation

Indiana received 0.5% of this total for furnishing the following finished products:

Rubberized Hair Pads
Leather Binding
Roller Chains
Sprockets & Gears
Vibrator Horns
Switches
Hood Lacings

Wisconsin received 0.5% of this total for furnishing finished and raw materials:

Brass Eyelets
Landing Gear Motors
Electric Fuel Gauges
Tie Rods
Flying Wires
Aircraft Cable

Massachusetts received 0.5% of this total for furnishing the following finished and raw materials:

Gears & Worms
Sprockets
Chain
Cabinet Locks
Universal Joints
Thread
Gimp
Sash Cord

New Jersey received 12% of this total for furnishing the following finished products:

Tab Control Parts
Engines
Starters
Generators
Primers
Stop Nuts
Engine Accessories
First Aid Kits
Carpeting
Instruments
Hinges
Leather Upholstery

New York received 8% of this total for furnishing the following finished or raw materials:

Propellers
Fuel Analyzers
Instrument Lights
Oil Radiators
Clocks
Instruments
Radio Equipment
Rubber Tubing
Engine Switches
Bearings
Balloon Cloth
Flitex Cloth & Tape
Packing
Canvas
Upholstery Materials
Grommets & Fasteners
Flexible Aluminum Tube
Forgings
Flexible Shafts

Michigan received 2% of this total for furnishing the following finished and raw materials:

Lacquer
Gasoline Gauges
Paint & Dope
Door & Window Handles
Castings
Leather Upholstery
Rubber Plugs
Ash Receivers
Landing Lights
Electric Terminals
Fuse Clips
Steel Tubing
Controls
Window Moulding

(Turn to page 106)

The Beechcraft Personnel Were Paid $681,000 During the Year For Their Work in 1939

Sheet Metal Workers Received	$194,000
Machinist, Tool & Die Makers Received	71,000
Painters Received	26,600
Upholsterers Received	9,500
Plant Maintenance Men Received	13,600
Woodworkers Received	21,150
Welders Received	67,000
Employees Under Production Planning & Control Received	31,150
Employees Under Plant Administration Received	12,600
Employees Under Executive Sales & Administration Received	45,000
Members of the Engineering Department Received	84,000
Inspectors Received	22,000
Engine Mechanics Received	14,400
Aircraft Assembly Mechanics Received	69,000

Distribution by Manufacture of Money Received for Aircraft During Fiscal Year 1939

Beech Aircraft Corp. Gross Income $1,300,000

Labor	16.5%
Power Plants	20%
Propellers	5%
Instruments	4%
Buildings Interest Depreciation	14%
Manufacturing Overhead	14%
Taxes	3%
Gas Water & Electricity	1%
Raw Materials	7%
Finished Products Purchased Other Then Motors, Props & Instruments	6%
Engineering	10%
Administration & Sales	8%
Tools Dies & Developments	3%
To Stockholders	00.00%

Capital Investment and Fixed Overhead Required for 1939 Production of 66 Biplanes—9 Monoplanes—Capital Investment $369,000—Fixed Overhead $280,000

Beech Aircraft Corp.

Buildings	$177,000
Real Estate	11,000
Shop Equipment (Jigs Tools & Dies)	141,000
Office Equipment	19,000
Landing Field	18,000
Car Trucks & Tractor	3,000
Depreciation on Office and Shop Equipment Tools, Jigs & Dies	21,300
Maintenance and Depreciation on Buildings	21,700
Development Cost	21,300
Interest	8,000
Selling & Administration Overhead	120,000
Manufacturing Overhead	145,000
Heat, Gas Water and Electricity	13,000
Taxes	33,000
Insurance	7,500

Cost Distribution of One Beechcraft Ship in Regular Production

	Percent
Paid to labor	25
Paid for engines	18.5
Charged to factory burden	18.25
Charged to commercial overhead	14.8
Used to purchase finished parts	9.6
Spent for engine accessories	4.25
Paid to purchase raw materials	4.2
Paid for instruments	2.8
Paid for absorbing engineering and development costs of experimental ships	2.6
Represents manufacturing profits	0.

Where Are Those Profits

(Continued from page 104)

Pennsylvania received 24% of this total for furnishing finished or raw materials

Engines & Accessories
Storage Batteries
Paint
Aluminum Bar
—Rivets
—Tubing
—Casting
Fuel Valves
Turnbuckles
Safety Glass
Steel Tubing
Moonglow Lamps
Motor Oil
Bolts & Nuts
Brass Chain
Zippers
Bronze Bushings
Rubber

Minnesota - Oklahoma - Texas received 0.2% for furnishing the following

Doortite
Bronze Bar & Castings
Mushn

California received 0.3% of this total for furnishing the following:

Electrical Fittings
Castings
Rubber Moulding
Toilets

Oregon received 2% of this total for furnishing:

Grade A Spruce

Geographical sources of raw materials used in construction Boeing Flying Fortress follow

Material received from the various states is as follows: **Washington:** silver, copper, lead, zinc, lumber, paper. **Oregon:** lumber, leather, silver, copper, lead. **California:** fish oil, mercury, petroleum, borax, lumber. **Nevada:** silver, copper, lead, zinc, mercury, manganese, tungsten, gypsum. **Idaho:** lead, silver, zinc, cooper, wool, lumber. **Montana:** leather, copper, silver, wool, zinc, manganese, instrument jewels. **Wyoming:** lead, gypsum, petroleum, lumber. **Utah:** copper, silver, zinc, asphalt. **Arizona:** silver, copper, molybdenum, vanadium, garnet, jewels. **New Mexico:** copper, lead, zinc, leather, fiber. **Colorado:** lead, copper, wool, silver. **North Dakota:** clay, leather, fiber, insulation. **South Dakota:** silver, tungsten. **Nebraska:** leather, fiber, casein, starch. **Kansas:** flax, petroleum, zinc, casein, lampblack. **Oklahoma:** zinc, lead, petroleum, leather. **Minnesota:** iron, paper, linseed oil, electrical parts, paints. **Iowa:** lead, zinc, starch, oil, steel parts. **Missouri:** lead, silver, zinc, fiber, leather. **Arkansas:** bauxite, abrasives, petroleum, cotton, antimony. **Louisiana:** sulphur, acids, fiber, paper, paraffin, lumber. **Mississippi:** cotton, leather, turpentine, resin, plush. **Alabama:** steel, silver, copper, lead, tin, graphite, bauxite, cotton, turpentine, resin. **Georgia:** iron, bauxite, manganese, talc, rosin, turpentine, resin. **Florida:** cotton, naval oil, sponges, turpentine. **South Carolina:** cotton, fabric, twine. **Tennessee:** cotton, silver, copper, rayon, plastics. **North Carolina:** cotton, talc, mica, turpentine, tar, resin. **Kentucky:** asphalt, alcohols, porcelains. **Indiana:** glass, ignition equipment, motor parts. **Illinois:** iron, steel, copper, instruments, insulators. **Wisconsin:** paper, leather, electrical machinery. **Michigan:** steel, copper, gypsum, brass, motor parts, hardware. **Ohio:** rubber, tires, tools, hardware, accessory parts. **West Virginia:** glass, carbon, black, steel, porcelain, chemicals. **Virginia:** fabrics, chemicals, paper. **Delaware:** steel products, paper, explosives, artificial leather, plastics. **Pennsylvania:** steel, glass, silk, paper, leather, fabric, tool parts. **New Jersey:** iron, zinc, textiles, chemicals, paints, plastics, accessories. **New York:** aluminum, zinc, glass, paper, wire, cable, plastics. **Connecticut:** instruments, engines, cables, machines, guns. **Rhode Island:** instruments, fabric, rubber, electrical accessories. **Massachusetts:** fabric, leather, silk, rayon, paper, electrical goods, machine parts. **Vermont:** slate, talc, fabrics. **New Hampshire:** mica, leather, fabrics, paper, rubber products. **Maine:** slate, lumber, leather, woolens, fabric, muslin.

Canada's Warplane Industry

(Continued from page 98)

Canadian Air Force, has started schools at St. Thomas, Ont., and Montreal, where mechanics and engineers can be trained. Every graduate from these schools is immediatey placed in some airplane plant or flying school as a ground member crew.

Aircraft plants have greatly expanded as to factory space since the beginning of the war. Just how much space has been added is not known, but reports at various times during the first year of the war show that many plants have more than doubled in size, including some which were not even finished when war broke out. How much of this plant expansion will be liable to exemption for income tax purposes is up to a recently created War Contracts Depreciation Board which has been formed to rule on amounts which may be written off on expansion for the carrying out of war contracts. Business firms will not be called on to pay income tax on full capital expenditures on plant and equipment which will have no value after the war.

And of interest to United States aircraft industrialists is the fact that Canadian companies by the latest war budget must pay a minimum income tax of 30 percent of their profits, and if those profits are higher than the average profits of the years from 1936 to 1939, the excess profits tax is 75 percent. A Board of Referees is being set up under provisions of the excess profits tax to pass on costs and depreciation claimed by firms in completing excess profits returns.

Just how Canada's aircraft industry will fare under these two boards is difficult to learn, for there is no doubt that much of the plant expansion necessitated by war orders will be of permanent benefit to Canada's post-war aircraft industry which by all appearances will repeat the history of the automotive industry's expansion after the first World War.

1941 Luscombe

(Continued from page 60)

full cantilever and require no bracing wires.

The fuselage is a full monocoque structure of .032 in. 17 ST Alclad skin, riveted to stamped Dural oval-shaped bulkheads. These bulkheads during construction are set up in one of the main fuselage jigs that are already drilled so that covering skins will fit exactly. The sheets of Dural have been previously drilled and curved on rolling machines and when ready to be attached to the bulkhead are clipped into place and riveted on with soft rivets. The entire rivet job for one fuselage takes four men but two hours—a remarkable production record.

The Luscombe landing gear is unique and employs only a single oleo and spring shock unit inside the fuselage. The landing gear is of semi-cantilever construction, requiring only a rigid metal strip instead of the usual strut in the center of the fuselage for the wheel axle.

A 15 gal. fuel tank back of the cabin gives an absolute range 375 miles. Useful load is 550 lb. and a 5 cu.ft. baggage department provides a space for an allowable luggage load of 55 lb. The wing loading of the 1941 trainer is 8.6 lb. per sq.ft.

The instrument panel contains all standard instruments including an air speed indicator. Special consideration is given to adapting the panel to blind flying instruments and two-way radio, the space having been allowed for proper installation of this equipment.

The new trainer in lines resembles very closely the familiar Models 8A and 8B, this one having taken the designation of 8B1. Specifications for the ship are as follows:

Model	8B1
Engine	Lycoming 65
Cruising speed	102 m.p.h.
Landing speed	35 m.p.h.
Climb first minute	900 ft.
Range	375 miles
Service ceiling	15,000 ft.
Span	35 ft.
Length	20 ft.
Wing area	140 sq.ft.
Wing loading	8.6 lb./sq.ft.
Power loading	18.5 lb./hp.
Wright empty	665 lb.
Useful load	535 lb.
Gross weight	1,200 lb.
Fuel capacity	15 gal.
Oil capacity	1 gal.
Baggage	55 lb.

Fig 19. Sub-assembly of Brush and Brush Housings

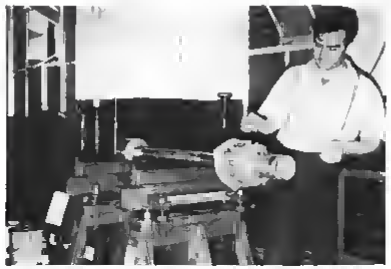


Fig 20. Balancing power unit on the Balance Ways

Curtiss Propeller

(Continued from page 43)

parts that are made within the plant is performed mainly in the machine shop so that when each part comes to the sub-assembly department, it is ready to be put together

Large work benches (Fig 19) are used upon which each unit is assembled by hand There is also a great deal of testing equipment for making certain of the accuracy of operation of each one of the individual parts A check is made at each step during the assembly and when the unit is complete, it is put through a test run and balanced (Fig 20) so that it will function properly when assembled on the propeller When the unit has been completed, it is inspected and then sent to the finished stores department waiting to be placed on the propeller

The Inspection Department

Heretofore the inspection department has only been referred to, but because of its thorough and complex operation, it warrants a separate description In fact, it is almost like a production line in itself, in that it follows all the material completely through the plant to make certain that at no time have any false moves been made that will injure the part The duties of the inspection department can best be explained by the following five steps Incidentally there is approximately one person in the inspection department for every five people engaged in direct fabrication of the propeller, that is, including all inspection such as receiving, shipping, Magnaflux, and heat-treating

1 *Receiving Inspection* whose function is to inspect all material coming into plant
2 *Floor Inspection* whose job it is to see that detail parts are properly machined and heat treated.
3 *Finished Stores Inspection* whose function it is to see that all finished material placed in stock is in accordance with requirements
4 *Assembly Inspection* whose duty it is to see that all assemblies are assembled and function properly
5 *Shipping Inspection* whose function it is to see that all material is properly packed and shipped in accordance with requirements

Assembly Department

When once all of the finished parts have been placed in the finished stores department, they are requisitioned out, as needed, to be assembled on the propellers In assembly, the first operation is to install the slip ring on the back of the hub After this the hub is placed on a lathe and the slip rings turned so that they are concentric with the hub shaft bore Then the hub is mounted on an assembly table and the blade gears, blade bearings, and nuts are assembled onto the blade These operations are done very rapidly and following them the next step is to set up the adapter plate to hold the blades at a fixed angle while they are assembled. When this is completed, the propeller is sent to the balancing pit (Fig 10) where the whole unit is balanced.

The power unit, having been previously balanced in the sub-assembly department does not need to be mounted on the propeller when the hub and blades are balanced In mounting this power unit, the cam is set so that the low pitch setting and the high pitch setting are correct. After these settings have been approved by inspection, a torque loading is applied to each blade by suspending a 100 lb weight from approximately 5 feet out on a lever arm and the propeller is operated as in normal service to see if the power unit is working correctly

After this test has been completed and checked, the propeller is dismantled (Fig 11) and sent to the shipping department (Fig 13). Located at the far end of the plant, the shipping department places the dismantled propeller into large y-shaped wooden boxes which are firmly closed and then sent out to the shipping platform.

In addition to these actual manufacturing operations there are numerous functions of the manufacturing department that are aimed at making propellers more rapidly and more efficiently For instance, a time study is made upon each machine and each operation and from this the ideal time for each operation is figured A group bonus system has been set up which pays more if a particular group exceeds the efficiency of the group compared to the time study Also from this time study the maximum rate of production of the plant as it exists is determined If the production rate is to be increased, then exactly what new machines that will be needed can be figured out from the time study and these additional machines bought or the present ones placed on additional shifts.

Steel Bladed Propellers

Earlier in this article a reference was made to the hollow steel bladed propellers that are under current production by the Curtiss Propeller Division These blades are not made at the Clifton, N J, plant, but are almost completely manufactured by the plant at Pittsburgh The high strength weight ratio of these propeller blades as well as their ability to resist abrasion has made them increasingly popular both in the military and commercial services. Although the production is not carried out in the Clifton plant, the unique process by which these are manufactured is certainly worthy of note and by its importance should not be omitted from an article describing propeller production

In the method of manufacture of the hollow steel blades, there are some 55 different operations. The first major step in this production is the milling of the steel plates. Upon a milling table the rectangular, flat plates (Fig. 23) are given a taper appropriate for the blade of which they are to form a part. While the taper varies, the average tapered plates have a difference in thickness from about ⅜-in. to approximately ⅛-in.

After this tapering operation, a cutting die punches out from the larger rectangular plate a section of flat tapered steel (Fig. 23) having the shape and the dimensions that can subsequently be pressed by forming dies (so that the greater part of this metal has the shape of the cambered side of a blade). The rest of this punched out piece of metal is shaped to form the shank of the blade. A smaller cutting die punches out from one of the smaller size rectangular tapered plates, a section of flat tapered steel having the shape and the dimensions of the flat or thrust face of a completed blade. Forming dies press this punched out metal to the form it would have as the flat or the thrust face of a completed blade. These forming dies are used with a large hydraulic press.

The welding together of these two pressings is one of the important major operations in the manufacture of the hollow steel blades. Each of these pressings has all the spring of chrome vanadium steel, and one end is only ⅛-in. thick while the other end close to ⅜-in. When welded together these pressings must make a structure that will be "hollow" to within ½-in. of the tip of the future blade.

Under these conditions, these pressings must be welded together so that both the weld and the metal adjacent thereto will have adequate strength for all conditions of stresses and strains.

All welding is done by the atomic hydrogen method. Special fixtures hold the two pressings while they are being welded, so that during the operation, the required pitch of the blade form is maintained.

The welded product is then immediately electric furnace heated to 1,700 deg. F. to remove all welding strains. The hub or shank end of the blade is then turned and the blade rough finished.

Heat treating is the major operation following. In electric furnaces equipped with self recording pyrometers the welded blades are heated to 1,650 deg. F. and quenched in oil. This quench required long and expensive study and especially designed equipment, before a technique was found with which the blade could be brought through quite straight and without impairment of the pitch. Immediately upon withdrawal from quench the blade is passed to a second electric furnace where it is held for three hours for draw at a temperature from 1,000 to 1,100 deg. F.

This heat treatment produces the following physical properties: elastic limit, 125,000 lbs. per sq. in.; ultimate strength, 138,000 to 145,000 lb. per sq. in.; elongation 12 to 15 per cent; reduction of area, 57 to 62 per cent. The steel in the blade having these physical properties, with its proportional limit well over 100,000 lb. per sq. in. and the average working stress not over 30,000 pounds.

Hollow steel blades are designed so that the center of gravity of all sections falls upon the straight line passing through the axis of the blade. The hollow construction makes it possible by the application of metal within the blade to correct the vertical and horizontal balance. There is a master blade used for horizontal balance. The vertical balance is secured by the use of a special cylindrical tube shaped tool. All of the parts of this being concentric with the axis of the tube, the center of gravity of this tool passes through the center line of the hub. By using this tool as the master blade against which each blade is check balanced and suspending the combination in vertical position, error in blade balance can be readily adjusted. The hollow steel blades can be adjusted for a vertical balance through a range of 180 deg., by the use of a special method for applying metal to the interior of the blade. Once the accurate balance of these blades has been adjusted at the Propeller Plant, flight service does not change it because the hardness of the steel makes the erosion of metal negligible.

The end gear which is attached at the blade root or shank is installed at the Clifton plant. This is practically the only operation that is performed on these blades at that plant, outside of inspection and, of course, balancing and assembly previous to shipping.

When the new plant at Caldwell, N. J., is completed in early October and production is under way, many of these operations will be performed in the new plant.

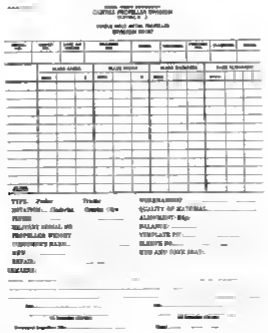


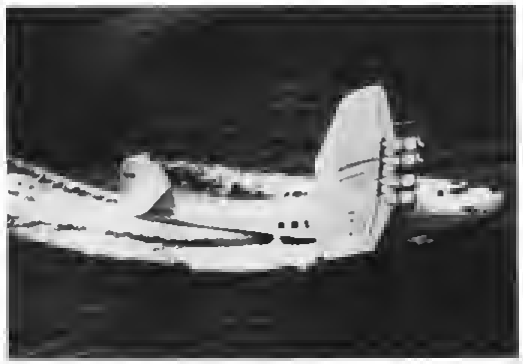
Fig. 22. The blade inspection report filled out for each blade.

Fig. 21. Types of forms used to record the order, schedule it through the shop and to check on the various production steps

Up 10,000 feet at

165 miles PER HOUR

on SKF ROLLER BEARINGS



The four engines on this clipper ship are rated at 830 h.p., 2400 r.p.m. at 6000 feet

Built by The Glenn L. Martin Co. with SKF Bearings on Double Wasp Engines built by Pratt & Whitney, one of three divisions of United Aircraft Corp.

LIKE A giant gull riding the waves, this Martin Clipper moves safely, swiftly and certainly. And a large part of this smooth performance is due to the smooth performance of SKF Bearings on crankshafts and control pulleys.

SKF Bearings are built to Army and Navy specifications. On the crankshafts, they not only have the *endurance* to take the surge of power from these Pratt & Whitney Double Wasp Engines, assuring a cruising speed of 165 miles per hour at 10,000 feet over a range of 3,200 miles, but they also have a one-piece retainer which permits ease of disassembly and a complete inspection of all parts. On control pulleys, they're lightweights, have high radial capacity and minimum rim wobble.

In making bearings for airplanes, SKF has the pride that comes from making a vital product so well that men whose lives depend upon it, select it. 4659

SKF

BALL & ROLLER BEARINGS

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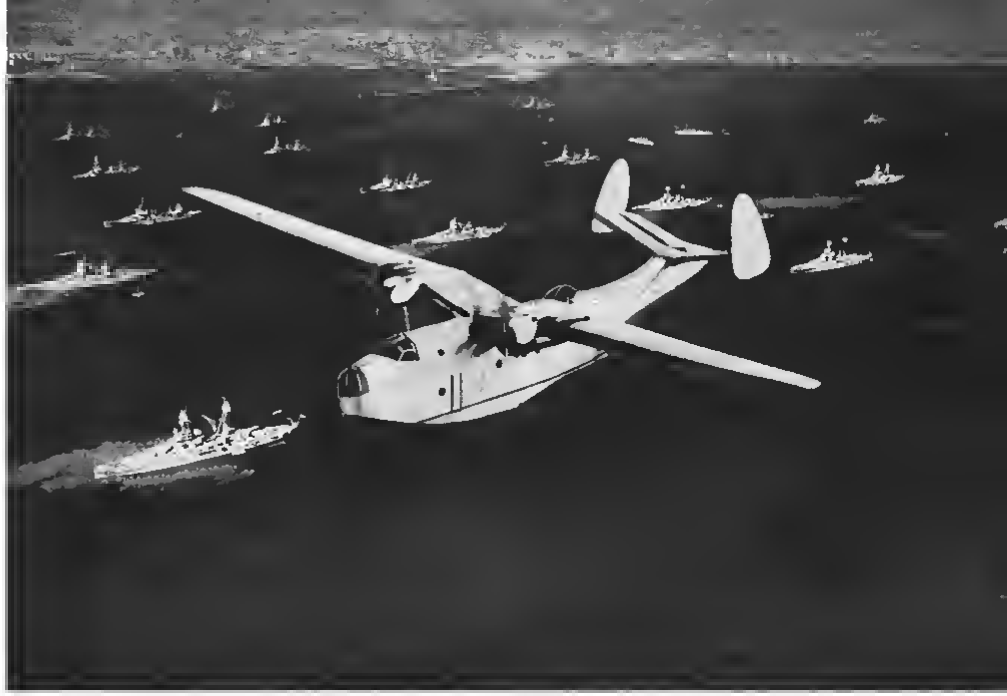

SISTER-SHIPS

As the United States faces a disturbed world, a new type of ship comes to the United States Navy—the Martin PBM-1—designed to range far and fast in the tireless watch of our far-flung coasts. Speeding far at sea, over thousands of miles in a ceaseless vigil, these patrol bombers will spot approaching danger and flash their warning back to share stations or the mighty sister-ships of the battle fleet. They can unleash their own thunderbolts in attack, heavy firepower in defense. Aboard are complete living quarters for the crew, for these cruisers-of-the-air may spend days at sea, basing at distant ports or on surface tenders. Here, then, are the newest, highly mobile outposts of the Navy; truly worthy additions to the defense of our shores.

THE GLENN L. MARTIN COMPANY, BALTIMORE, MARYLAND

Builders of Dependable Aircraft Since 1909

TRADE MARK

MARTIN

Financial Outlook

(*Continued from page 51*)

plant recently completed, was valued at about $2,000,000. Together with other Stinson facilities, the price paid by Vultee for all of the properties involved appears low. It is likely, however, that the significance of this transaction may lie elsewhere.

Divested of the bulk of its properties, the Aviation Manufacturing Corp is left only with its Lycoming division. For all practical purposes, this engine division is the only operating property remaining in Aviation Corporation.

Hence, Aviation Corporation virtually becomes an investment trust. As already noted, it owns 752,168 shares, or about 75 percent of Vultee. In addition, it owns $2,422,122.50 in American Airlines 4½ percent convertible debentures due July 1, 1941. When converted these debentures will give Aviation Corporation a 34 percent stock interest and control of American Airlines. Such ownership could not be lawfully retained without approval of the Civil Aeronautics Board. It is possible that this contingency led Aviation Corporation to divest itself of properties manufacturing for the commercial air transport market.

Not to be overlooked in Aviation Corporation's portfolio is 163,475 shares, or about 9.5 percent of the capital stock of Pan American Airways. Sundry other investments are also owned by Aviation Corporation, but are relatively unimportant.

Control of Aviation Corporation reposes in Aviation & Transportation Corporation, which owns 1,181,801 shares, or about 29 per cent of the former's capital stock outstanding. This top holding company, commonly known as ATCO, also owns a diversified group of other investments, including New York Shipbuilding Corporation and Auburn Automobile Company.

It can thus be seen that ATCO and Aviation Corporation are now similar in character. It would not be surprising, therefore, if Aviation Corporation were dissolved and its assets distributed to its stockholders. In this process ATCO would become the sole holding company and investment trust. Should this be done, each share of ATCO would receive, among other things, about 1/10th of one share of Vultee and about 1/25th of one share of American Airlines.

Should Aviation Corporation be dissolved, it would mark the end of a company that has experienced one of the most turbulent corporate careers of all time.

Back in early 1929, a dozen or so of the more imposing investment houses offered to the public 2,000,000 shares of stock at $20 a share. With this abundance of cash, Aviation Corporation bought a scattered group of small transport lines, one line even went to Alaska and another to Cuba. Along with its hodge-podge of air lines, Aviation Corporation also purchased flying schools, airplane factories, a motor bus line, and a broadcasting station.

At its peak, Aviation Corporation had eighty-odd subsidiaries. There were frequent changes in the corporate management of this organization, including one wild and widely publicized proxy battle. Aviation Corporation has come a long way since those early days and has seemingly reached a period of relative calm.

Stated for simplification as well, is the intercorporate structure of Pan American Airways System. There are fourteen operating subsidiaries of Pan American Airways Corporation of Delaware, in addition to nine other more or less inactive subsidiaries along with approximately half-interests in Pan American Grace Airways and China National Aviation Corporation. Tax liabilities of the component units have been a burden on the top company with the consolidated tax bill for 1939 amounting to about one-third of taxable income.

Estimates place tax savings at about $300,000 annually through the elimination of unnecessary corporations based on last year's results. With consolidated income of $1,984,438 for last year, such savings would have added about 22 cents per share to the $1.41 reported for 1939.

In February, 1940, the company offered 525,391 shares of its capital stock, upon which it realized $6,250,000. Such proceeds were applied toward new equipment purchases. The expansion of the company's operations, however, appears to have utilized this added capital along with recent earnings. While $2,820,000 in equipment trust certificates were outstanding as of December 31, 1939, it is believed that the balance of the authorized $3,500,000 has since been issued.

New Lines Contemplated

Two new lines, one from South America to Africa, and another branching off from the Far Eastern route to the Dutch East Indies, are contemplated in the company's expansion program. These projected routes are believed to stand a good chance of obtaining approval from the necessary Government agencies as a vital step in strengthening the defense of the Western Hemisphere.

Since the Association of American Railroads confirmed reports that it has under consideration a plan calling for a nationwide air-freight company to be owned jointly by the railroads and air lines, considerable speculation has been created as to the participation of the railroad industry in the future growth of aviation. Thus far, the association of rail and radio beam has been an unhappy one.

When the old Transcontinental Air Transport, Inc. (predecessor of TWA) was formed in 1928, the Pennsylvania Railroad invested $502,000 in this enterprise for the purpose of establishing a combined rail and air route from New York to Los Angeles. The entire trip took more than two complete days and over schedules which at best were uncertain.

As the Atchison, Topeka and Santa Fe Railroad operated the western end of the train run, it had an agreement to sell tickets for this combined rail-air service. It was largely because of its railroad sponsorship that TWA now parallels the route of the Pennsylvania and Santa Fe.

The Pennsylvania found it advisable in 1935 to forego its aviation investment and stepped out with a sizeable loss. The Santa Fe has long since stopped selling air travel tickets for TWA. Ironically, the Pennsylvania and Santa Fe are currently losing some of their choice passenger traffic to the air carrier they helped create.

The Kansas City Southern Transport Company, Inc., subsidiary of the Kansas City Southern Railway, has been attempting to obtain a certificate of convenience and necessity to operate an air line, but thus far to no avail. More recently, the Seaboard Air Line Railway formed Seaboard Airways, Inc., to petition for certificates covering routes from Boston to Miami and New Orleans. The outcome of these applications is open to conjecture.

The Boston & Maine Railroad and its subsidiary Boston & Maine Airways, Inc. were more successful in obtaining authorization from both the Interstate Commerce Commission and the CAB to operate combined air and rail passenger service on one ticket covering a one-way flight and one-way by rail, for points between Boston and Bangor. The results of this experiment may prove interesting.

Comprehensive investigations and cost studies of air freight operations are envisioned by the interested railroad group. The contention is advanced that the railroads should enter the air freight business on the ground floor before it makes serious inroads in freight revenues like the air passenger service has on rail passenger business. The virtually untapped air freight market is fraught with tremendous implications as to its ultimate control by the contending transportation agencies.

Research—Part II

(Continued on page 41)

the Smithsonian Institution, and six other members who are outstanding authorities, appointed by the President for terms of five years; they include Dr. Orville Wright, Dr. Vannevar Bush (chairman), Dr. George Mead, Dr. Edward Warner, Dr. J. C. Hunsaker, and Dr. Robert E. Doherty.

Under the committee are four main subcommittees on aerodynamics, power plants, structures, and materials. To the main subcommittees is attached a group of fifteen special subcommittees on special topics relating to the work of the main committee. All these committees are made up of experts in their fields, from the military services, from other government agencies, and from civil life. The function of the committees is to prepare the research programs of the NACA as a whole.

The actual conduct of aeronautical research is in the hands of the director of aeronautical research, Dr. George W. Lewis, who has made notable contribution to the aeronautical sciences during the past twenty years. Dr. Lewis is recognized all over the world as a leader in aeronautical research. The first-rank position attained by American aircraft and engines—both in commercial and military fields—owes much to his work.

The secretary, John F. Victory, directs the administrative work of the NACA. His broad knowledge of governmental procedure and experience with the committee's policies since its creation in 1915, have been a material influence in the efficient functioning of the organization.

As of the first of this year a new office has been established under the committee, that of the coordinator of research. Its purpose is to maintain close liaison with all organizations, governmental and private, that operate research facilities. An important part of the job is "the stimulation of all aeronautical research in scientific and educational institutions to supplement research in government laboratories." With this in mind, an extensive survey has been made of the potential research capacity of the United States. Most of the universities that have any equipment or personnel suitable for any aeronautical or allied research have been visited and their facilities tabulated. As a parallel project, the Army, the Navy, the NACA laboratories, and many airplane and engine manufacturers have been contributing lists of problems suitable for research in educational institutions. Under the direction of the committee and its subcommittees, work is now in progress to set up research projects in many educational institutions that heretofore have not been participating directly in aeronautical work. As corollary to this program, the NACA is cooperating very closely with all branches of the aviation industry.

The same sort of program is being worked out for the new National Defense Research Committee. Although it will probably not engage in research in its own laboratories as does the NACA, it will carry the cooperative research idea much further. Funds will be available to spend for needed research in university and industrial laboratories. As an executive agency, it is empowered to enter into contracts for research of all kinds for mechanization and instrumentation of the nation's fighting forces.

Inventions Pour In

There is nothing like a national emergency to bring out the inventors. Hundreds of letters are being received every day in various government agencies, describing ideas and inventions all the way from trick cotter pins up to death-ray devices allegedly capable of blasting battleships out of the water or airplanes out of the air, at 100 mile distances. Among the various ideas that are suggested, there are undoubtedly many of real significance. Among a thousand impractical ideas there may be only one that makes any sense, but that one may be so important that we cannot afford to overlook it. The Patent Office is working very closely with the research committee. An inventions council is being set up within the framework of the Department of Commerce to look over carefully all ideas that are submitted and to do some preliminary weeding out before they reach the patent application stage. The council is to be made up of fifteen engineers from industry and will be headed up by Charles F. Kettering.

Of such are the tasks that have been assigned to the National Defense Research Committee. No one knows yet how far its work may ultimately extend. We will probably not know the full story of its activities until long after the present emergency has passed, for obviously much of the work being done is of such a confidential nature that it must be kept strictly off the record.

We do know, however, that whatever this committee is doing, its work has been placed in capable hands. When the President made his appointments he selected the best men in the field to assist Dr. Bush. Top people in the fields of physics and chemistry and economics have been drafted for the job. Dr. Richard C. Tolman, dean of the Graduate School of California Institute of Technology, has been appointed vice chairman. The rest of the committee includes Rear Admiral H. G. Bowen, designated by the Secretary of the Navy; Conway P. Coe, U. S. Commissioner of Patents; Karl T. Compton, president of Massachusetts Institute of Technology; James B. Conant, president of Harvard University; Frank B. Jewett, president of the National Academy of Sciences; Brigadier General G. V. Strong, designated by the Secretary of War; Dr. Irvin Stewart, of New York, has been appointed secretary of the committee. Headquarters have been set up in the office of the Carnegie Institution of Washington.

Although the National Defense Research Committee is concerned chiefly with research on weapons of war and not their production, it is working in the closest sort of cooperation with the Advisory Commission to the Council of National Defense. It is cooperating with many other governmental and private agencies on a wide range of related problems. For example, its work is geared closely with that of the National Academy of Sciences and the National Research Council. These two quasi-federal agencies are advisory bodies, whereas the National Defense Research Committee is an executive agency empowered to encourage and support necessary research on highly confidential matters. To be sure, some of the work of the National Academy of Sciences and the National Research Council is of a confidential nature, but their primary functions are to deal with advances on broad scientific and technical matters. Their work will, however, be coordinated with that of Dr. Bush's new committee.

War places a great strain on the health and welfare of all individuals. In order to assure that American citizens will be physically fit for whatever responsibilities they face in the defense program, research on problems of health and public welfare is being coordinated by Miss Harriet Elliott, member of the National Defense Advisory Commission in charge of Consumer Protection. Four governmental agencies are cooperating. A coordination committee has been appointed, which includes Surgeon General Thomas Parran, to direct activities involving public health; Miss Catherine Lenroot, chief of the Children's Bureau, Department of Labor, to direct activities dealing with child welfare; Arthur J. Altmeyer, chairman of the Social Securities Board, to direct general activities in this field, and Dr. M. L. Wilson, director of Extension Service, Department of Agriculture, who will concern himself with general food problems.

Thus, research of all kinds in America prepares to drop its normally peaceful habits and gird for war.

Goodyear Blimps

(*Continued from page 40*)

at one time they may cruise for 45 min at $5 each. The flights begin at 11 a.m. and continue until dark and are operated without profit to the Goodyear company. There is a good deal of pleasure in this type of flying and, as the ship floats along at 40 miles an hour, there is no pronounced sense of motion—just a faint roll from side to side, or a slow rise and fall as the craft passes through different air currents. The cabin, or gondola, holds 6 passengers in comfortable, bus like chairs. In front sits the pilot, in an armchair, with a wheel at his right hand for controlling climb or descent. His feet rest on a pair of pedals, for steering. Above the forward window is a row of control knobs that resemble electric fuses and which are used to control the distribution of helium gas, to make the ship more buoyant in the nose or stern as may be necessary to compensate for atmospheric changes. At the pilot's left hand is the throttle for the two engines, suspended on each side of the gondola, while before his eyes there are many instruments including the compass, altimeter, air speed indicator, fuel gauge, oil pressure, etc. From a hook above the window hang a set of radiophones, for each ship is equipped with a two-way radio and maintains ground contact at all times. The dirigible usually cruises at an altitude of 1,500 ft and the panoramic view spread below is ever an awe-inspiring spectacle to the novice.

To get the small ships into the air a ground crew of some fifteen men is needed. When he is ready to rise, the pilot signals and the crew swings on the handrails along the outside of the gondola. They bounce the craft on and off the ground several times, letting it rebound from the powerful spring attached to the landing wheel. After three or four of these bounces the "up" signal is given and each man of the ground crew heaves into the air with his full strength and the dirigible soars aloft.

Non-rigids make no ambitious claims to long distance flying, although the Naval C-2 flew 2,200 miles from New York to Cape Charles Light and returned in 33 hr. and 6 min. The Defender cruised from Akron to Miami with one intermediate stop, 1,240 miles, and smaller Goodyear ships have several times made flights of 500 and 600 miles. The best record in speed perhaps ever made by a Blimp was attained by the Puritan which flew from Akron to Langley Field, Va., covering the 425-mile trip in 5 hr., or better than 80 m.p.h.

These small dirigibles have been more fortunate than most aircraft, meeting most of the hazards of weather in the United States, Canada, Mexico and Cuba—riding through wind, hail, snow and sleet storms and out of the menace of fog, although the company's policy is not to send a ship aloft in bad weather except in an emergency. Only when a Blimp has been damaged enough not to be rebuilt is its name stricken from the rolls. Latest of these was the eleven-year-old Puritan which had carried 95,000 passengers, flown more than 600,000 miles—an unusual record for a non-rigid airship—before being caught in the hurricane that flashed through New England in September, 1938. The airship Vigilant was taken off the list in 1930 when it flew into a mountain side in a dense fog in northern Alabama.

Goodyear built a large airship dock at Wingfoot Lake, near Akron, during the war, large enough to accomodate five Blimps at a time. The company erected docks alongside its plants at Gadsden, Ala., and Los Angeles, Cal., and one at Pal-waukee Airport, Chicago.

Oil-burning Engines

An interesting development in 1931-32 was a diesel-type motor of Packard design, 225 hp., which was successfully installed on the Defender. Oil-burning engines of this type will remove the last item of fire hazard from lighter-than-air craft. The small ships also proved useful in testing the gelatin-latex fabric which had been developed for the gas cells of the U.S.S. Akron and Macon, replacing goldbeater skin.

Three forms of advertising by Blimps—neon signs for night flying, advertising streamers for day flights, and powerful loud speakers—have attracted wide attention. The neon characters are 6 ft high by 4 ft wide, weigh 650 lb., consist of a maze of glass tubes, and each unit can form any number or any letter of the alphabet. There are ten of these units and they can be attached to the bag of a dirigible in 15 min. While in the air, an automatic mechanism spells out the message, one word at a time, and is operated from a perforated tape, similar to that used in player-pianos, which can be so adjusted that it will repeat the message over and over again. New tape can be prepared while in flight, on a special machine similar to a typewriter, and different messages flashed at will. The streamers used in the daytime consist of characters 8 ft high and up to 450 ft long. As the Blimp gets into the air this floating sign is held in a horizontal position by the slip-stream from the motors. The loud speakers, called "Cloud Speakers," operate effectively up to 1,500 ft. and in addition to their advertising uses have aided police in directing traffic at bottle-neck spots. The neon signs and streamers can be read a mile away.

Of the 19 pilots in active duty with the fleet, three have been flying since the World War. Captain J. A. "Jack" Boettner, Chief of Airship Operations, with more than 10,000 hr., is a veteran balloon and airship pilot and is the holder of the first airship pilot's license issued by the U. S. Department of Commerce. He was instructor at Wingfoot Lake during the war, breaking in hundreds of Army and Navy men as pilots of balloons and airships. The average number of hours in the air for Goodyear pilots is in excess of 5,000 and the flight personnel have averaged better than 11 years as licensed pilots, and made 40 Atlantic crossings on dirigibles while in training. Eight are officers in the Naval Reserve and are available for duty with the fleet in an emergency.

The first step in training a lighter-than-air pilot is the free balloon. Each novice must become a licensed balloon pilot before receiving training on airships—as an airship becomes a free balloon and is handled in exactly the same manner should its engines stop. Balloon training is conducted at the company's Akron base by men with race victories to their credit. In addition to air-training, the student is required to pass ground school courses of extreme rigidity and usual courses on engines, navigation, aerodynamics, etc., must be supported by aerostatics, chemistry of gases, airship design and maintenance, and fabric construction.

Tasks performed in peace-time by the Blimps include locating of forest fires, photographic and rescue work, spraying for insect control, police scouting and traffic directing, surveys, and map and movie making. During the World War no convoy was attacked when guarded by an airship and in the seventeen months prior to the Armistice, British airships sighted 49 submarines and successfully attacked 27 of them; they convoyed 2,000 surface vessels and carried out over 9,000 anti-submarine patrols—and from Jan. 1 to Nov. 11, 1918, there were only nine days in which these ships could not fly because of bad weather. Both sides in the present World Conflict are using lighter-than-air craft effectively. Acting as an aerial listening post—for the Blimp can hover over a given spot—carrying of infra-red optical range locating apparatus, map making photography and related work are among other war activities.

RUGGEDNESS PROVED BY "Torture Tests!"

...to bring you an important margin of safety!

Here's Airline Safety in a Light Plane Receiver at only **$99.50**

FOR B BATTERY OPERATION

RCA MODEL AVR-15

with Separate Traffic Control Channel

HERE, at the price of a "bargain-quality" radio, is a real *quality-radio* bargain! RCA-built, CAA-approved, and tested under conditions which would quickly put a dressed-up broadcast receiver out of commission, the RCA Model AVR-15 brings you *extra* ruggedness reliability and efficiency, for uncompromising safety . . . *plus* the convenience of a separate Traffic Control Channel! Just a snap of a switch shifts your receiver from Tower frequency to Beam frequency . . . *instantly*. No dial-twiddling. No lost time. You need not take your eyes from your flying!

Yet the RCA AVR-15 is yours for only $99.50, for operation from light, compact "B" Batteries! With 6- or 12-volt Vibrator-Type Power Supply, it's only $133.50.

Don't buy any aircraft receiver until you've seen how much extra quality and performance RCA can give you for so little. Write today for literature—*now*, before you forget!

40° BELOW ZERO! In sub-Arctic temperatures, this RCA Model AVR-15 receiver had to prove its ability to "take it" . . . and perform perfectly! Through a dozen tests as tough as this, the AVR-15 came out with flying colors!

131° FAHRENHEIT AT 95% HUMIDITY! As hot as the steaming jungle at its worst! And the AVR-15 still performed perfectly for hours without dangerous overheating!

SHOCK TEST. 100 free falls from heights of 6" to 18", without shock mountings of any kind! Tests like this prove the AVR-15 can take the brunt of rough treatment day after day and not let you down!

VIBRATION TEST. Prolonged vibration is something every light-plane receiver must meet in service. This test, far more severe than any actual conditions your receiver will ever meet, proves the AVR-15 will stand up indefinitely without breakage, loosening, or circuit-component changes, at vertical accelerations as high as 10G's!

For Dependability, it pays to use the tubes preferred by most airports and pilots—RCA RADIOTRONS

RCA

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RCA MANUFACTURING CO. INC. CAMDEN, NEW JERSEY
A SERVICE OF THE RADIO CORPORATION OF AMERICA

Confidence

★ *Beechcraft render owner-satisfaction in all climates. Shown here is Captain H. D. Hoffmann, President of ARCO —Jungle Express, Colombia South America, with a party of friends.*

Obviously, the best judges of any product are the people who have used it.

Among the owners of BEECHCRAFT biplanes are included the U. S. Army, the U. S. Navy, the Brazilian Navy, the Department of Commerce, the Department of Transport of Canada, the Department of Civil Aeronautics of Brazil, several state governments, and many prominent airlines and individuals all over the world.

It is with gratitude to the loyalty of these owners, therefore, that we announce that we have at the present time a backlog of orders for 26 BEECHCRAFT biplanes, *all to be delivered to organizations and individuals that are already BEECHCRAFT biplane owners.*

The acid test of confidence and satisfaction in any piece of equipment is repeat orders. BEECHCRAFT biplanes continue to meet this test, just as they have met it from the beginning.

Deliveries can be made with reasonable promptness, in view of the present defense situation.

BEECH AIRCRAFT CORPORATION ★ 6411 CENTRAL AVENUE ★ WICHITA, KANSAS

Ryan School

(Continued from page 53)

criticized. But in this instance their judgment was such that they put the general welfare ahead of any such consideration. The success of the program has been such that it becomes a great encouragement in times like these when many are prone to believe there is a general lack of old-fashioned American intestinal fortitude and foresight.

It is also a tribute to the civilian flying schools of this country that they have successfully met the challenge in this respect we can consider our civilian schools as a first line of defense for the United States. So it is important that we examine that line of defense in order to appraise its present strength and future possibilities.

With one exception the Ryan School of Aeronautics is typical of the nine commercial flying schools now conducting the Army's primary flight training program. The exception is that Ryan has served as the proving ground for the adoption of the low-wing monoplane primary trainer. This move marks a departure from a 30-year precedent of biplane primary trainers.

We are especially proud that the trainer selected for this purpose was our own Ryan S-T which had already made a name for itself in private flying circles as well as in many commercial flying schools. As adopted by the Army Air Corps, following extensive flight testing at Wright Field the Ryan is designated the PT-20 and incorporates a number of refinements from the previous models. The Ryan monoplane trainer speeds up the transition stage from primary to advanced training for two reasons. First is that the Ryan has higher performance than older type training planes. It is unusually responsive to the controls and so tends more nearly to approximate the planes of higher performance to which the primary pilot advances when he is given advanced training. Then this low-wing monoplane trainer produces pilots who adapt themselves more readily to the low-wing monoplane types which are now practically standard for all classes of military combat planes.

Like other commercial flying schools now cooperating in the Army pilot training program, the Ryan School of Aeronautics is continuing to conduct its civilian activities. Coordinated with the Army cadet program at the Ryan School of Aeronautics are civilian flight, mechanic, and engineering courses, a sheet metal course for aircraft workers, and a CAB flight instructor standardization course which is preparing instructors to teach the advanced CAB training program. A pre-requisite of this standardization course was that the school giving it must be engaged in Air Corps primary training work with Air Corps approved instructors and equipment. The advantages of this will be obvious in that it insures that the graduates of the CAB advanced course will be trained to military standards and so represent a trained reserve pilot reservoir in the event of a great military emergency.

It was not an easy matter to undertake the Air Corps cadet training program. Housing facilities for the cadets had to be provided. This was done by the erection of unit-type barracks near the field and overlooking both the field and the bay. These barracks were complete with kitchen, mess hall, and recreation room, constituting a miniature Army post.

Then it was necessary to obtain additional field facilities. Lindbergh Field, base of the Ryan School, could not carry the entire load of an additional intensive training program. This problem was solved by buying and leasing two suitable auxiliary fields for training work, removing most of the cadet flying from the Lindbergh Field area.

A further problem was provision of instructors. This was solved through selection of commercial flight instructors, many of whom had originally received their training in the Ryan commercial school or who had been operating Ryan training planes at civilian schools. These men, along with a group of instructors from the Ryan school staff, were sent to Randolph Field for standardization training in Army flight procedure. Following their return to our school this original group has given such standardization training to other instructors from time to time, thus increasing the staff to 37 men who have completed the Army Air Corps Instructor's course. This involves giving each instructor about 25 hours of flight instruction before putting him to work on cadet training, regardless of the amount of experience he may have had prior to that time. It is anticipated that future needs for instructors can be met rapidly by this process of 'standardizing' commercial instructors to Army flight methods.

Now that the Air Corps program has been further expanded, to provide for primary training of 7,000 cadets annually, Ryan facilities have been enlarged to meet the need, just as is being done by all nine of the civilian schools operating under the program. It is comforting to consider the relative speed and ease with which these schools have doubled their facilities. And it is safe to say that this same process can be continued further if the need arises, so that we can train 14,000 instead of 7,000 cadets annually within another year or two. And, given a three- to five-year program, which would match the expansion of manufacturing activities, the commercial schools can raise the ante to 28,000 pilots, and then to 56,000 pilots a year, or more if needed.

An example of the mechanics of this expansion is found in the figures on Ryan training activities. For the past year we have taken a new class of 35 cadets every six weeks, but now are receiving 65 cadets every five weeks at the San Diego training detachment alone. In addition to this we have built an entirely new school at Hemet, Calif. which will enroll 70 cadets every five weeks. This actually represents a five-fold increase over our 1939–1940 schedule. The Hemet school, now under construction, includes two hangars, each 140 x 150 ft., an administration building, Army office building, medical building, instructor's office, two classrooms, and six laboratories. There are also eighteen housing units under construction, each of which accommodates eight cadets, or a total of 144 cadets. A large mess hall, including kitchen and canteen, as well as a cadet lounge, is also being provided. There will be other facilities such as barber shop and store added from time to time as an accommodation to the personnel.

The present Army pilot training program—to produce 7,000 pilots per year—calls for continuation of the nine commercial schools on a greatly expanded basis. A total of 1,292 students will enter these schools every five weeks. About two-thirds of these student cadets will graduate and be sent on for basic, advanced and specialized training to one or more of the three Army training centers at Randolph Field, Texas; Moffett Field, Calif.; or Maxwell Field, Ala. The over all pilot training program is accomplished in four phases, including ten weeks of elementary training, ten weeks of basic training, ten weeks of advanced training, and five weeks of specialized training in combat types. Thereafter the cadet is graduated to a service squadron and receives additional flight and military training as a part of his regular army duties.

At Ryan our schedule provides that the lower class shall fly between 8 a.m. and noon, while the upper class attends ground school lectures. In the afternoon the upper class flies from 1 p.m. to

(Turn to page 126)

AA Rookies

(Continued from page 45)

by the Federal Committee on Apprenticeship, U S Department of Labor

Each mechanic enrolled is scheduled for a minimum of 144 hours per year on related classroom subjects.

In the American Airline plant at LaGuardia Field the mechanic specializes in the particular field that he likes best and where he is most needed. He learns as he earns. When he is finished with this course he is thoroughly trained in the specialized, highly technical work required by modern aviation.

A one-year course for selected graduates of aeronautical engineering is offered by the engineering department of which William Littlewood is vice president in charge. Students with mechanical training who have taken options in aeronautics are considered for application.

Throughout the year the student advances, training in the various departments: airplane overhaul, engine overhaul, manufacturing, instrument overhaul, engine build-up and engine changes, line maintenance.

Lectures by directors of American Airlines departments and instructors are followed by examinations. The student is urged to specialize in one phase of the work so that when the course is finished, he is an A-1 engineer trained to meet American's needs.

J. G. Flynn, Jr., superintendent of communications, is in charge of the continuous school for radio operators.

Four or five men in a group are given individual instruction and supervision by operators in the New York communications room at unused positions. Examinations follow instruction. The course continues for four weeks. Applicants to the radio school must have a federal communications commission license, must be well up on their code, for high speed is required on duty.

Through this system of schooling, American Airlines, Inc., for years has selected the best available employees and trained them for the specific work needed for leadership in the air transport business.

New mechanics spend a portion of each day in classrooms where they are instructed by men from different departments of the line.

Factory Training In the East

(Continued from page 100)

of the plant so smoothly is that both employment and training have been done efficiently.

Some years ago Mr. Mattoon established a regular four year apprentice course and many former apprentices occupy responsible jobs with Curtiss. At present about 50 young men are in the class. In addition Curtiss has worked closely with the Burgard Vocation School in Buffalo and has many of its graduates. Burgard is now giving a 10 weeks class under the auspices of the National Defense Training Program. The first class had 500 students, and Curtiss now has about 150 of them at work.

The Company's chief criticism of the National Defense classes is that they are too general in nature. Curtiss has its own short-course classes, and boys can learn as much there in four to six weeks as in the ten weeks class outside. Within the plant, a boy is trained for a specific job and concentrates on it, while outside the plant a student is usually not sure where he is going. Curtiss feels that factories will probably have to give a short, intensive course to graduates of National Defense classes. It is also felt that lack of competent instructors is a potential source of weakness.

At present Mr. Mattoon has plans for widening his training methods. As the Company expands, new schools will be started in both St. Louis and Columbus. Special training is also being planned for older men who can be quickly prepared for aviation jobs. A cooperative plan with universities in three cities, Buffalo, St. Louis and Columbus, will be used to train engineers. In addition, company schools will operate in all three plants.

Ryan School

(Continued from page 124)

5 p.m., while the lower class receives technical instruction.

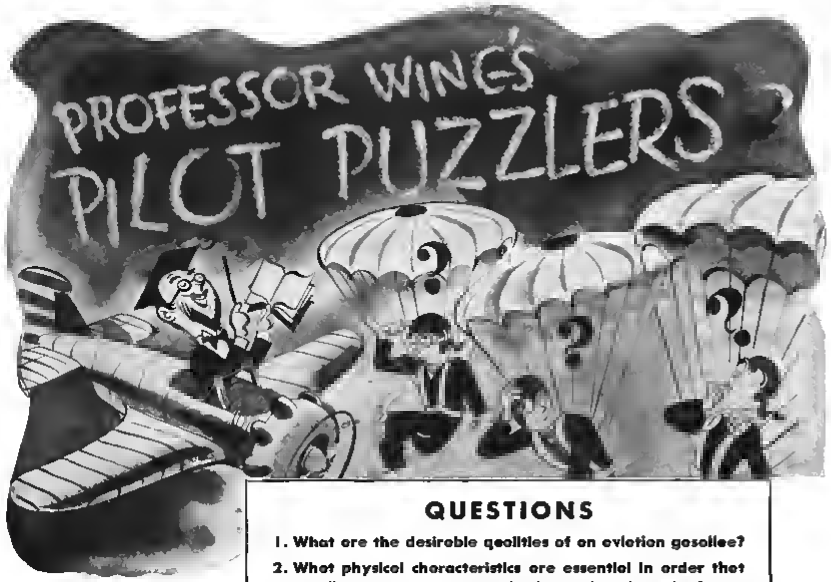
Ground school instruction is divided between classroom lectures and demonstration lectures. In the latter the instructor demonstrates the actual operation of some important function of the airplane or engine, such as fuel system, controllable propeller, etc., to a group of not more than ten cadets. The actual flying course is divided into primary, solo and advanced stages. Primary stage taking up to 10 hours, includes: use of controls, straight flight, confidence maneuvers, climbs and turns, glides and turns, stalls, power on and off, spins, figure "S" patterns, take-offs and landings, forced landings, solo.

Solo stage, from the 10th to 20th hours, stresses perfection of take-off and landing maneuvers, reviews primary stage maneuvers, and includes elementary eights.

The 20th to 60th hours are the accuracy and aerobatic phases and include: 90-deg. accuracy stage, 180-deg. side approaches, 180-deg. overhead approaches, 360-deg. overhead approaches, chandelles, lazy eights, pylon-eights, review of primary maneuvers, forced landings, aerobatics to include loops, half rolls, slow rolls, snap rolls, Immelman turns, vertical reversements and precision spins.

For the benefit of those readers who may not know the requirements for appointment as a flying cadet, the candidate must be an unmarried citizen of the United States, between the ages of 20 and 27 at time of application. He must have completed two years of college or its equivalent, and must pass the required physical examination.

By the methods outlined above we are producing trained pilots rapidly and efficiently. The men who are applying for the Air Corps pilot training program represent the highest type of young American manhood and we are proud to be associated with them in this work. We have every reason to believe that with such men, and by such methods, America can produce whatever number of military pilots she may need to meet any emergency which may arise.



QUESTIONS

1. **What are the desirable qualities of an aviation gasoline?**
2. **What physical characteristics are essential in order that an oil may give proper service in an aircraft engine?**
3. **What is the significance of pour point in an oil?**
4. **Why is automotive gasoline not suitable for use in aircraft engines?**

THE more experienced pilot chooses his gasoline for *balance*. He demands that his motor jump to answer the throttle—but not at the expense of economy and cruising range.

In Shell Aviation Gasoline he finds this all-round *balance*. Shell, you know, was the first to produce commercially 100-octane fuel. And today flyers both private and commercial rely on Shell for safe, flexible, economical performance.

Ask Shell for help on your fuel or lubrication problems. Call or write Shell Aviation Department, 50 West 50th Street, New York City, or Shell Building, San Francisco.

ANSWERS

1 High anti knock value, high heat value per pound, ease of starting, good volatility, low vapor pressure, stability in storage, freedom from gum, low freezing point, cleanliness.

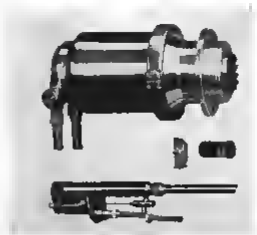
2 Body (viscosity) sufficient to maintain a satisfactory oil film under the maximum temperatures and pressures encountered, lowest viscosity possible in keeping with foregoing condition, maximum resistance to oxidation and decomposition under high operating temperatures, sufficient fluidity at the minimum temperatures of operation to provide adequate lubrication at starting, freedom from corrosive action on metals, minimum carbon forming tendencies, absence of light or volatile components.

3 The pour point of an oil is the lowest temperature at which the oil will pour when chilled under definite conditions. The lower the pour point, the more fluid the oil will be at cold temperatures.

4 Aside from the fact that automotive gasoline may not be sufficiently high in anti knock rating for most aircraft engines, it has a higher vapor pressure which would be likely to cause vapor lock at higher altitude (reduced atmospheric pressure). In addition, automotive gasolines are usually lower than aviation gasoline in heat content per pound and, therefore, the useful load that can be carried is less due to the necessity of providing for additional weight of fuel for any one trip.

SHELL

AVIATION PRODUCTS



Breeze Cartridge Starter, with breech, toggle switch and cartridge.

Radio Ignition Engine and Auxiliary Shielding . Spark Plug Radio Shieldings . Multiple Circuit Electrical Connectors . Flexible Shielding Conduit and Fittings . Conduit Junction Boxes . Cartridge Engine Starters . Dichromatic Cartridge Containers . Internal Tie Rods . Propeller Pitch Controls . Elevator and Rudder Tab Controls . Flexible Shaft and Case Assemblies . Aeroflex Jr. Flexible Instrument Lines . Tachometer, Fuel Pump and Remote Control Drives . Ammunition Rounds Counters . Radio Tuning Units . Generator and Ignition Filters . Engine Primers Single or Multiple . Fuel and Oil Tanks . Exhaust Gas Analyzers (Fuel-Air Ratio Indicators) . Flexible Tubing of Stainless Steel, Aluminum, etc. . Resistance Type Thermometers . Swaging Machines and Hand Swaging Tools.

Stainless Steel Division: Pioneers in the design and development of stainless steel structures and fabricated products.

REMEMBER when it took three or four of the huskiest boys on the field to "wind 'er up" on a cold day? Human energy was stored in a flywheel to be delivered effectively to the engine.

Such things are far simpler today. A cartridge is slipped into the breech—the pilot touches a switch—and smooth, powerful torque is applied to the engine by the Breeze Cartridge Starter. Under the most difficult starting conditions, the Cartridge Starter delivers the same high-speed cranking motion, no matter how frequently used.

Light in weight, and unaffected by heat or cold, Breeze Cartridge Starters are designed and manufactured with the background of experience which for years has made Breeze products standard with the aviation industry.

BREEZE MARK

Breeze CORPORATIONS INC.
NEWARK, NEW JERSEY

24 cents it cost...

to send a letter on the first trans-continental air mail flight, just 20 years ago last month.

82 hours time . . . flying by day, going by rail at night . . a far cry from the fraction-of-a-day, fraction-of-the-cost service we have today.

An amazing change in both planes and accessories has made this improvement possible, and with this change, the standard for Control Cable has grown increasingly higher. But, because Roebling keeps pace with the requirements of the Industry for Control Cord, you will find it is *still* standard equipment on a large percentage of planes carrying the nation's mail.

JOHN A. ROEBLING'S SONS CO., TRENTON, NEW JERSEY

Roebling Aircraft Products are available either tinned, galvanized or Stainless Steel, in regular or preformed constructions

KEEPING PACE WITH AN INDUSTRY WHOSE WATCHWORD IS PROGRESS

Masters of MASS PRODUCTION *Rely on* LYON METAL PRODUCTS

Steel bins weighing approximately 400 pounds per cubic foot are carried in and on top of the Standard Shelving Rack above

Wide aisles and good lighting combine with Lyon Standard Shelving to provide accurate filing and efficient handling of thousands of castings stocked in a wide variety of shapes and sizes

● For fifty years leaders in the development of America's unmatched mass production technique have called upon Lyon Engineers for co-operation in planning storage facilities to match manufacturing efficiencies.

Neatness, simplicity and system . . basic factors in the effective operation of modern production programs . . . are apparent in stockrooms, tool rooms and warehouses equipped by Lyon Storage Engineers

Requisitions and orders are filled in less time, with fewer errors, and stocks are carried on less floor space. Inventory taking is simplified. The cost of handling stock is reduced. Tool losses are practically eliminated. Fire hazards are minimized.

Lyon Steel Storage Equipment lasts indefinitely. Changing conditions do not affect its value, because it is quickly adjustable to growing volume or new requirements.

The qualities of convenience, strength, durability and economy, which have made Lyon Equipment the choice of masters of mass production, are characteristic also of other Lyon Products . . tool cribs, shop boxes, tool lockers, shop benches and other equipment that steps up production efficiency. Mail coupon for detailed information on Lyon Steel Storage Equipment and practical survey service. LYON METAL PRODUCTS, INCORPORATED, Aurora, Illinois

LYON SHOP EQUIPMENT *Service*

LYON METAL PRODUCTS, INCORPORATED, Aurora Illinois

LYON METAL PRODUCTS, INCORPORATED
6850 River Street, Aurora, Illinois

☐ Please send full sport colors on Lyon Storage Survey Service. Also data on items checked: ☐ Steel Work Benches; ☐ Shop Boxes; ☐ Bar Racks; ☐ Tool Lockers and Materials Handling Carts; ☐ Steel Shelving; ☐ Steel Lockers.

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(See index on this page)
(See also Group Classifications)

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INDEX

AVIATION "Classified"—October, 1940

Undisplayed ads offering only ONE make of plane are grouped under that make. Others appear under "USED PLANES—General" and are numbered and indexed to enable readers to conveniently locate the makes of planes offered or other items of interest. All other undisplayed and displayed ads—excepting those relating to employment and business opportunities—are numbered, are referred to by number, and indexed for the readers' convenience in quickly finding ads.

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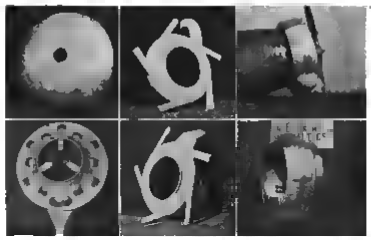

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